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A MONOGRAPH
OF THE
SILURIAN FOSSILS OF THE GIRVAN DISTRICT
IN AYRSHIRE
WITH SPECIAL REFERENCE TO THOSE CONTAINED
IN THE "GRAY COLLECTION"

FASCICULUS II.

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OF THE

GIRVAN DISTRICT IN AYRSHIRE



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A MONOGRAPH

OF THE

SILURIAN FOSSILS OF THE GIRVAN DISTRICT IN AYRSHIRE

WITH SPECIAL REFERENCE TO THOSE CONTAINED
IN THE "GRAY COLLECTION"

BY

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AND

ROBERT ETHERIDGE, JUN.

F.R.P.S. Ed.

OF THE GEOLOGICAL DEPARTMENT OF THE
BRITISH MUSEUM

FASCICULUS II.

(TRILOBITA, PHYLLOPODA, CIRRIPIEDIA
AND OSTRACODA)

WILLIAM BLACKWOOD AND SONS
EDINBURGH AND LONDON
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PREFACE TO THE SECOND FASCICULUS.

THE present Fasciculus is occupied wholly with the Crustacea of the Silurian rocks of Girvan, and contains the Trilobita (continued from the First Fasciculus), the Phyllopoda, the Cirripedia, and the Ostracoda. We had originally hoped to include in the present part the *Polyzoa* of the area under consideration, but we have found this impossible, upon two grounds :—

In the first place, indisposition on the part of one of us has considerably interfered with the production of the present Fasciculus, and has compelled us to make it shorter than we would otherwise have done,—a deficiency which we trust to be able to compensate for in the Third Fasciculus.

In the second place, a new series of researches which have been carried out during the past summer by Mrs Gray in the Girvan district, to a large extent in localities not previously examined, has resulted in placing in our hands a very large mass of additional material relating to the Protozoa, Coelenterata, and Crustacea ; and either embracing new forms, or in various respects adding to the already available information as to forms formerly described.

Under these circumstances, we have decided to publish in the Third Fasciculus an extended Supplement, dealing with

all the new material which we have obtained in connection with the groups of animals above mentioned. The amount and importance of the additional material in question would seem to render this a preferable course to that of waiting till we are enabled to publish a "General Supplement" at the end of the entire work. The preparation of the Third Fasciculus is now well advanced, and we shall include in it, not only the Supplement above spoken of, but, if space permits, also the section dealing with the Polyzoa.

In connection with the present Fasciculus, we have to express our gratitude to the Royal Society for further assistance from the Government grant. We have also to return our best thanks to our friends Dr Henry Woodward, F.R.S., and R. B. Newton, Esq., for assistance in working out the Trilobites; to Professor T. Rupert Jones, F.R.S., for his great kindness in supplying us with notes on the Ostracoda; and to T. W. Newton, Esq., for help in the verification of authorities and references.

We are greatly indebted and obliged to Professor Kjerulf for the loan of certain specimens for comparison from the Christiania Universitets Mineralkabinet, which were of the greatest use to us in our investigations of the genus *Ampyx*.

As in the case of the Trilobites dealt with in the First Fasciculus, the plates have been drawn and put upon the stone by our friend Mr Charles Berjeau, F.L.S.

UNITED COLLEGE, ST ANDREWS, AND
BRITISH MUSEUM, LONDON,
November 1879.

A MONOGRAPH
OF THE
SILURIAN FOSSILS OF THE GIRVAN DISTRICT.

CRUSTACEA (*Continued*).

Genus LICHAS, Dalman (*continued*).

Lichas Geikiei, Etheridge jun. and Nicholson, (*sp. nov.*)

(Pl. X., fig. 1.)

Spec. char..—General form oval, but wider in front than behind. Head irregularly semicircular, the anterior portion tumid and projecting in front, and divided into seven lobes; forehead-lobe expanded in front, overhanging the upper lateral lobes, contracting posteriorly to a narrow neck, and then expanding widely to a narrow base which is cut off by the neck-furrow; upper lateral lobes reniform, their inner margins, or those next the forehead-lobe, indented by a small notch (in casts); they do not extend posteriorly to the neck-furrow, being cut off by the expanded base of the aforesaid forehead-lobe; lower lateral lobes far apart, larger than the upper, and of a different shape; basal lobes oval, somewhat large and interrupting the neck-furrow. All the furrows separating the lobes are deep, wide, and well marked (in casts); the upper lateral lobes are almost

but not quite circumscribed, the furrows not quite meeting towards their lower portions; the basal lobes are deeply circumscribed below (in casts), but not so in their upper part. The neck-furrow in its central part is broad and shallow, but against the basal lobes becomes deep and well marked. Facial suture anterior to the eye gradually and gracefully curving outwards to the front margin; but posterior to the eye, it is, for a short distance, parallel to the neck-furrow, curving round the small scar representing the eye; again it turns parallel to its former course; and it cuts the posterior margin at about half-way between the basal lobe and the lateral margin of the head-shield. Free cheeks or wings of a peculiar antler-like elongated form, with a concentrically-striated broad front edge; genal angles rounded, not produced. . Eyes not preserved, but represented by oval scars occupying the most elevated or convex portion of the free cheeks. Surface of the frontal lobe (and the others?) with scattered tubercles.

Thorax of eleven somites, and, as preserved, devoid of ornamentation; the axis is about two lines wide, broad and convex; the pleuræ are about three lines, or a little more, in width, deeply grooved from the axis nearly to their distal ends, the extremity of each being slightly expanded and rounded.

Pygidium broadly oval and composed of four short coalescent rings; the axis gradually contracts to a bluntly-rounded posterior extremity, from which a small median ridge arises uniting it with the outer posterior border, which is finely lineate; the margin does not appear to have been ornamented with projecting spines.

Obs.—Our specimens are quite decorticated, so that the more or less granular ornamentation so characteristic of the genus *Lichas* is not to be detected save on the pygidium, and even there it is very ill preserved. The frontal portion of the glabella is very tumid, but the latter narrows rapidly as it recedes towards the posterior margin. The free cheeks have the usual rounded and broadly falcate form seen in *Lichas*.

We have carefully compared our specimens with the English species of *Lichas* (*L. anglicus*, *L. Barrandii*, *L. Grayii*, *L. Bucklandi*, *L. laxatus*, &c.), and with those from Sweden, figured by Angelin, and from Bohemia by Barrande.

The blunt axis and rounded entire margin of the pygidium at once distinguish this from all those species of *Lichas* with spinous tails. Of described forms, it otherwise approaches nearest to *L. laxatus*, M'Coy, and *L. verrucosus*, Eichwald; but in the former the eyes were evidently much larger. The nature of the tail forbids any reference to *L. Barrandii*, Fletcher, *L. hirsutus*, Fletcher, and *L. laciniatus*, Dalman; whilst the form of the head at once separates *L. Geikiei*, from *L. anglicus*, Beyrich.

The Swedish species *L. cicatricosus*, Lovén, appears somewhat near our specimens in the general form of the glabella; but the respective pygidia, again, show them to be very clearly distinct. This is also the case with *L. sexspinus*, Angelin.

None of the Bohemian species of *Lichas* approach this Girvan form, except, perhaps, *L. heteroclyta*, Barr,¹ which possesses a rounded limb to the pygidium without any extension into spines. It is, of course, just possible that small spines may have existed round the margin of the tail, and have been removed with the outer shell; but even supposing this to be the case, there are other points of difference which will, we think, separate this form as distinct. We are therefore led to the conclusion that our Girvan *Lichas* must be considered as specifically distinct from any which has been heretofore described, so far as we have been able to ascertain; and we therefore propose to associate with it the name of Professor A. Geikie, LL.D., F.R.S., to whom we are indebted for the loan of specimens from the Collection of the Geological Survey of Scotland.

Loc. and Horizon.—Drummuck, in a fine-grained, greenish sandstone or mudstone (*Coll. Geol. Survey, Scotland*). Collected by Mr A. Macconochie.

¹ Syst. Sil. Bohême, i., t. 28, f. 33.

Genus CYPHASPIS, Burmeister, 1843.

(Die Organ. der Trilobiten, p. 103.)

Cyphaspis megalops, M'Coy.*Harpes megalops*, M'Coy, Sil. Foss., Ireland (1846), 1862, p. 54, t. 4, f. 5.*Harpidella megalops*, M'Coy, Annals Nat. Hist., 1849, iv. p. 412.

" " M'Coy, Brit. Pal. Foss., 1852, fas. 2, pp. 143-368.

Cyphaspis " Salter, Mem. Geol. Survey, Dec. vii., No. 5, p. 1, t. 5.

" " Salter and Woodward, Chart. Foss. Crustacea, 1865, f. 104.

" " Salter, in Murchison's Siluria, 1867, 4th ed., p. 235, foss. 65, f. 2.

" " Bigsby, Thesaurus Sil., 1867, p. 49.

" " Woodward, Cat. Brit. Foss. Crustacea, 1877, p. 34.

Obs.—Unfortunately we have not been able to obtain specimens of this interesting Trilobite from Girvan, although it is recorded from there by Professor M'Coy,¹ and Sir Wyl. Thomson.² Through the kindness of Professor T. M'K. Hughes, we have been able to examine the specimen in the Woodwardian Museum, and find it to be in a very unsatisfactory condition for exact determination. Sir Wyville Thomson's example we have not seen.

Loc.—Mulloch Quarry, near Girvan (*Woodwardian Museum*, and *Coll.*, *Sir Wyl. Thomson*).

Genus CALYMENE, Brongniart, 1822.

(Hist. Nat. Crust. Foss., pp. 7 and 9.)

Calymene Blumenbachii, Brongniart.

(Pl. X., figs. 2-6.)

Calymene Blumenbachii, Brongniart, Hist. Nat. Crust. Foss., 1822, p. 11, t. 1, f. 1 a-c.¹ Brit. Pal. Foss., p. 368, as *Harpidella*.² Quart. Jour. Geol. Soc., xiii. p. 209.

- Entomolithus paradoxus*, Linn., Act. Soc. Sci. Holmiensis, 1759, p. 22, t. 1, f. 3.
- Trilobites Blumenbachii*, Schlotheim, Nachrichten, 1823, ii. pp. 131-133.
- Calymene* „ Dalman, über die Palæaden, &c., 1828, p. 35, t. 1, f. 2 and 3.
- „ „ Green, Monthly American Jour. Geol., i. 1832, No. 12, p. 558.
- „ „ Bronn, Lethæa Geog. 1835, i. p. 110, t. 9, f. 3.
- „ „ Hisinger, Lethæa Suecica, 1837, p. 10, t. 1, f. 3 and 4.
- „ „ Emmrich, de Trilobitis, 1839, p. 39.
- „ *senaria*, Conrad, Ann. Rep. Pal. N. York, 1841, p. 49.
- „ *Blumenbachii*, Portlock, Geol. Report, Londonderry, 1843, p. 285, t. 3, f. 1a.
- „ „ Mantell, Medals of Creation, 1844, ii. p. 555, p. 553, lign. 121, f. 3, 4, and 4^a.
- „ „ Geinitz, Grundriss, 1846, p. 225, t. 9, f. 2 *a* and *b*.
- „ „ Burmeister, Organ. Trilobites, 1846, p. 81, t. 2, f. 1-3 (English edition).
- „ *senaria*, Hall, Pal. N. York, 1847, i. p. 238, t. 64, f. 3 *a-n*.
- „ *Blumenbachii*, Mantell, Wonders of Geol., 1848, ii. p. 789, lign. 178.
- „ „ Salter, Quart. Jour. Geol. Soc., 1851, vii. pp. 171, 172, t. 9, f. 1 *a* and *b*.
- „ „ var. *niagarensis*, Hall, Pal. N. York, 1851, ii. p. 307, t. 67, f. 11 and 12.
- „ „ F. Roemer, in Bronn's Lethæa Geog., 1851-1856, i. 2 Theil, p. 612, t. 9, f. 3, t. 9¹, f. 24 *a* and *b*, t. 9², f. 15.
- „ „ Barrande, Syst. Sil. Boh., 1852, i. p. 566; Atlas, t. 19, f. 10, t. 43, f. 46-48; Supp. 1872, p. 36, t. 14, f. 33, t. 15, f. 15.
- „ *spectabilis*, Angelin, Pal. Scandinavica, 1854, p. 28, t. 19, f. 5.
- „ *Blumenbachii*, Morris, Cat. Brit. Foss., 1854, 2d ed., p. 102.
- „ „ Buckland, Bridgewater Treatise, 2d ed., 1858, ii. t. 64, f. 1-3.
- „ „ Eichwald, Lethæa Rossica, 1860, i. p. 1420.
- „ „ F. Roemer, Sil. Fauna, W. Tennessee, 1860, p. 179, t. 5, f. 22.
- „ „ Salter, Mon. Brit. Trilobites, 1865, pt. 2, p. 93, t. 8, f. 7-16, t. 9, f. 1 and 2.
- „ „ Salter, Mem. Geol. Survey, 1866, iii. p. 326, t. 17, f. 1-7; and vars. t. 17, f. 9, 13 and 14.
- „ „ Salter, in Murchison's Siluria, 1867, 4th ed., p. 68, foss. 13, f. 1, t. 17, f. 1, t. 18, f. 10.
- „ „ Bigsby, Thesaurus Sil., 1868, p. 42.
- „ „ Lyell, Students' Manual of Geology, 1871, p. 450, f. 541.
- „ *senaria*, Hall and Whitfield, Ohio Geol. Survey Report, i. pt. 2 1873, p. 173, t. 14, f. 14, *a-f*.

- Calymene Blumenbachii*, Dana, Manual of Geology, 2d ed., 1875, p. 120, f. 167, p. 202, f. 361.
 „ „ Salter, Cat. Camb. Sil. Foss., Woodwardian Mus. Cambg., 1873, pp. 53, 77, 132, and 166.
 „ „ Lyell, Students' Manual, 2d ed., 1874, p. 464, f. 530.
 „ „ F. Roemer, Lethæa Geog., 1876, Atlas, t. 17, f. 15.
 „ „ Woodward, Cat. Brit. Foss. Crustacea, 1877, p. 28.
 „ „ de Koninck, Foss. Pal. Nouv. Galles du Sud., 1876, p. 55.
 „ *Niagarensis*, Miller, American Pal. Foss., 1877, p. 213.
 „ „ Etheridge jun., Cat. Australian Foss., 1878, p. 15.

Obs.—The above synonymy may be considered as in a measure supplementary to that given by Mr Salter in his 'Monograph,' and embraces a number of important and selected references.

We do not think it necessary to redescribe this common, widespread, and well-marked Trilobite, as Salter's diagnosis will be found sufficient for all purposes of identification.

Calymene Blumenbachii occurs plentifully at one or two localities in the Girvan district, usually in the form of internal casts, but occasionally a specimen is found with portions of the integument remaining. When in the former state, the various glabella-furrows, as well as those of the thorax and pygidium, are, by removal of the old thick crust, exceedingly well marked, broad, and deep. This is especially to be noticed in the marginal furrow of the glabella in individuals from Drummuck, where the species occurs in the greatest profusion, and of the largest size. So very marked is this in some cases, as to cause the strong prominent margin to project sensibly forward, indicating a transition towards *Calymene tuberculosa*, Salter. Again, examples are not wanting in which the knots, or blunt tubercles, down the sides of the thoracic axis, are quite as well marked as in any of those examples figured by Mr Salter,¹ although not so prominent as in the var. *Allportiana* or *C. tuberculosa*. In all probability such a specimen caused one of us to record² the occurrence of *C. tuberculosa* at Girvan, although

¹ Monograph, t. 8, f. 12 and 15.

² Mem. Geol. Survey, Scot., Expl. 3, 1873, p. 31.

we cannot at the present moment refer to the fossil; so far, however, as the "Gray Collection" is concerned, we have not observed any *Calymene* in which the frontal margin is so projecting or snout-like as in the latter species. In only one specimen is the integument sufficiently well preserved to show the ornamentation, but in this particular instance there is an entire absence of the tubercles generally seen on *C. Blumenbachii*, and the surface is simply scabrous or microscopically granular, a feature met with in certain varieties of the latter, according to Salter, and also a character of *C. tuberculosa*, and to some extent of *C. senaria*, Conrad. The Collection of the Geological Survey of Scotland possesses an unusually well-preserved example, in which the whole of the head is after this pattern. In nearly all the examples of the pygidium of *C. Blumenbachii* from Girvan, the bifurcation of the pleuræ is well marked. There are, however, examples from Mulloch in which it is scarcely perceptible; this is especially the case in small specimens.

As regards the general outline of the Girvan form of *C. Blumenbachii*, it appears to us to approach nearer to that variety called by Salter *Caractaci*, than with the true "Dudley Trilobite." The length, as against the width, when compared with the measurements of the latter, accord better to our minds with those of the elongated body of the variety than with the squarer form figured by Salter as characteristic of the true species.

With the view of ascertaining to how many species the *Calymenæ* of Girvan may be referred, we have made a most careful comparison with the species of this genus represented in the collections of the British Museum and Museum of Practical Geology. Our investigations in this direction, and the material from Girvan at present in our possession, have led us to the conclusion that the true Dudley form of *C. Blumenbachii* either does not exist in that area, or is of only rare occurrence; at any rate we have not met with any examples.

On the other hand, we were at first inclined to refer the South

of Scotland forms to two species, but after mature consideration we think it best for the present to look upon the specimens as only referable to one. This, as before stated, resembles both *C. Blumenbachii*, var. *Caractaci*, and *C. senaria* in the elongated body; but so far as the first of these is concerned, the difference between it and ours consists in the much broader frontal lobe of the latter, especially in its most anterior part.

As to *C. senaria*, we would point out that the glabella, as bounded by the axial furrows, is of a much more triangular form than that seen in any of the Girvan fossils. Again, the fixed cheeks are of a different outline, assuming a more laterally elongated appearance in the latter than in the former. On the other hand, an undoubted approach to *C. senaria* is to be found in the ornamentation of the Girvan Trilobites, which is simply microscopically granular, but without the "larger and smaller tubercles" of *C. senaria*; nor is it "roughly tubercular," as in *C. Blumenbachii* proper.

Under all circumstances, therefore, we look upon the form now under description as a variety of *C. Blumenbachii*, intermediate in some of its characters between *Caractaci* and *C. senaria*. It is the var. *a* of Mr Salter.¹ The labrum of this species is occasionally met with in the Girvan beds. Mr Salter has already given a figure of one, and we now represent the impression of another *in situ* (Pl. X., fig. 3) in the Trilobite.

Loc. and Horizon.—Ladyburn, above Drummuck (Etheridge);² Ladyburn, opposite Thrave (Etheridge jun.);³ Roughneuk quarry (Etheridge jun.);⁴ Drummuck (Gray Collection, &c.), in a fine-grained liver-coloured rock; Mulloch Hill (Gray Collection), in a fine-grained dark sandstone (?). Chiefly as specimens with the integument removed.

In addition to the foregoing localities, a tail has been met with by Mrs Gray in the shale at Craighead Quarry, and portions of the body of two individuals in the greenish-grey mudstone of Penkill.

¹ Monograph, t. 9, f. 2.

² Mem. Geol. Survey Scot., Expl. 14, 1869, p. 9.

³ Ibid., Expl. 3, 1873, p. 31.

⁴ Ibid., p. 30.

A last fact worthy of notice is, that all the individuals from Mulloch Hill are much smaller than those from Drummuck; and it is just possible that if any specific separation is hereafter required, the respective forms met with at these two localities may represent the two species.

Genus REMOPLEURIDES, Portlock, 1843.

Remopleurides, Portlock, Geol. Report, Londonderry, 1843, p. 254.

Caphyra, Barrande, Notice Préliminaire, 1846, p. 32.

Remopleurides et Amphitryon, Corda, Prodom einer böhmischen Trilob., 1847, pp. 111-113.

Remopleurides, Salter, Mem. Geol. Survey, Dec. vii., No. 8, 1853, p. 1.

„ Barrande, Syst. Sil. Boh., 1852, i. p. 356.

Obs.—The late Mr J. W. Salter proposed to subdivide *Remopleurides* into two sections, depending on the presence or absence of furrows on the glabella. For the latter section Portlock's original term was retained; whilst for the former Barrande's name, *Caphyra*, was used, being next in order of precedence. This appears to us to be a very natural division of the genus, and it affords us much pleasure to carry out Salter's proposal. If we pass in review the species of *Remopleurides* known to us, we find that they fall very naturally into one or other of these two sections, thus—

Section *Remopleurides*.

R. affinis, Billings.

R. Canadensis, do.

R. Colbii, Portlock.

R. dorsospinifer, do.

R. laterispinifer, do.

R. longiscostatus, do.

R. obtusus, Salter.

R. Panderi, Billings.

R. platyceps, M'Coy.

Section *Caphyra*.

R. quatuorlineatus, Angelin.

R. radians, Barrande.

R. Schlotheimi, Billings.

R. sexlineatus, Angelin.

So far as we know, all the species hitherto described from British rocks belong to the section *Remopleurides*, with one exception, *R. (Caphyra) radians*, Barrande, which is found in

Wales. We have to introduce in succeeding pages another member of the latter section.

Section Remopleurides. The glabella devoid of furrows.

Remopleurides Colbii, Portlock (?).

(Pl. X., figs. 8-8 a.)

- Remopleurides Colbii*, Portlock, Geol. Report, 1843, p. 256, t. 1, f. 1.
 „ *Kolbii*, Emmrich, N. Jahrbuch, 1845, p. 45.
 „ *Colbii*, M'Coy, Sil. Foss., Ireland (1846), 1862, p. 43.
 „ „ Salter, Mem. Geol. Survey, Dec. vii., 1863, No. 8, p. 1,
 t. 8, f. 1, a-f.
 „ „ Morris, Cat. Brit. Foss., 1854, 2d. edit., p. 115.
 „ „ Salter and Woodward, Chart Fossil Crustacea, 1865,
 f. 40.
 „ „ Bigsby, Thesaurus Sil., 1868, p. 67.
 „ „ Woodward, Cat. Brit. Foss. Crustacea, 1877, p. 57.

Spec. char.—Glabella, large, convex, anteriorly bent down, but flattened or gradually sloping off towards the posterior margin; sides arched outwards; without the anterior projection or lip the glabella is broad-oval—with it, it is strongly urceolate; the base is well indented by the eyes, and the posterior margin straight. Lip, tongue, or anterior projection bent down, becoming almost vertical in front, separated from the anterior portions of the eyes by deep notches (in casts). The axial furrows immediately bound the glabella, and on arriving at the anterior extremity of the eye, they become much deeper, broader, and (as before stated) notch-like. Then they are immediately bent down, following the outline of the tongue or lip, and on reaching, but without touching, the rostral suture, are bent inwards towards the centre of the tongue; here the two prolongations approach but do not meet, thus leaving a portion of the latter between them as a small prolongation. Eyes placed more or less in a vertical position, very large, semi-lunar, much wider anteriorly, but posteriorly indenting the base of the glabella, passing obliquely downwards and inwards, and facetting with the neck-

segment. The eyes, on their lower margins, are also bounded by grooves and narrow borders continuous with the rostral groove. The eye-lobes towards the anterior end are reduced to mere rims, but over the attenuated posterior portion of the eyes they expand horizontally and project; surface of the eyes microscopically reticulate, with innumerable lenses. Rostral shield well marked. Free cheeks small and triangular; posterior angles produced into spines; neck-furrow narrow and not particularly well marked, widening under the attenuated posterior ends of the eyes; neck-segment wider than the base of the glabella. Surface of the latter apparently unornamented. Of the thorax, only four segments are preserved; axis convex, wide, but not equal to the width of the glabella. Pleuræ short, falcate, directed backwards and downwards, and almost separated into two portions by a deep oblique furrow, which does not, however, pass quite to the acute apex in each pleura; the forward margin of each pleura is provided, just at its junction with the axis, with a projecting fulcral tubercle, and at a corresponding point on the posterior margin with a deep notch for the reception of the tubercle of the succeeding pleura, and with a raised border. The axis-segments are ornamented with transverse striæ and granules, and the posterior margin of each is pectinated by a row of projecting tubercles; the pleuræ are obliquely striated, the striæ distant from one another.

Obs.—The above characters are essentially those of the Girvan specimen, and are given at length in order to show how far it agrees with Salter's description of *R. Colbii*, and to what extent it differs. We are under obligations to the officers of the Museum of Practical Geology for permission to examine in detail the fine set of specimens of this genus under their charge; the types, in fact, figured by Portlock and Salter. Our Girvan specimen, a weathered internal cast, appears to agree with *R. Colbii* in almost every particular; it is, however, a little larger, and is not entire. The study of the above specimens quite enables us to appreciate the difficulty under which Mr

Salter laboured in arriving at a satisfactory conclusion relative to the specific value of the three names, *R. Colbii*, *R. laterispinifer*, and *R. dorsospinifer*, "except, of course, in the remarkable appendages to which the specific names refer," as he himself says.¹ As the Girvan form does not retain the afterpart of the thorax and the pygidium, we think it more prudent to place a note of interrogation after the name, although, in our minds, there exists very little doubt as to its identity with the first of the above species. It certainly does differ from *R. Colbii* in the proportions of the pleuræ to the remainder of the body; they here appear larger, and of a slightly different shape. According to Salter, the axis-segments of the thorax are crossed by transverse lines; but a close examination of the type-specimen has convinced us of more than this. To us the lines look like closely-applied sub-imbricating granular laminæ, tubercular on the hinder edge of the somite, and having very much the appearance, at first sight, presented by the body-segments of the Carboniferous *Eurypterus Scouleri*, Hibbert.

From *R. Panderi*, Billings,² the present species is easily distinguished by the peculiar single furrow on each side of the glabella of the former. In *R. Canadensis*, Billings,³ there are again, obscure furrows present, and the form and length of the eyes are entirely different from that of *R. Colbii*. In *R. affinis*, Billings,⁴ the general proportions are quite different, the glabella is not so broad or convex, the eyes are much longer, and the form is not the same. In *R. platyceps*, M'Coy,⁵ the glabella is flattened and the eyes (described as cheeks) form a narrow semi-lunar margin, giving rise to quite a different arrangement to that seen in the present form.

Loc. and Horizon.—Drummuck, in a fine-grained mudstone (Gray Collection); so far as we are aware, this species has not hitherto been recognised as a Girvan form.

¹ Decade, vii. p. 6. ² Canadian Pal. Foss., p. 293, f. 283. ³ Ibid., i. p. 182, f. 164.

⁴ Ibid., p. 325, f. 313.

⁵ Sil. Foss., Ireland, p. 44.

Remopleurides laterispinifer, Portlock.

(Pl. X., figs. 10, 11; Pl. XI., fig. 15.)

- Remo. laterispinifer*, Portlock, Geol. Report, 1843, p. 256, t. 1, f. 2.
 „ *laterispina*, Corda, Prod. Mon. böhm. Trilobiten, 1847, p. 113, t. 6,
 f. 59.
 „ *laterispinifer*, Salter, Mem. Geol. Survey, Dec. vii., No. 8, p. 4, t. 8,
 f. 2-2 c.
 „ „ Morris, Cat. Brit. Foss. 2d ed., 1854, p. 115.
 „ „ M'Coy, Synop. Sil. Foss., Ireland (1846), 1862, p. 43.
 „ „ Bigsby, Thesaurus Sil., 1868, p. 67.
 „ „ Woodward, Cat. Brit. Foss. Crustacea, 1877, p. 57.

Obs.—We have before us several specimens, in two of which the peculiar development of the seventh pleura on each side is visible, and from which the form derives its name. In neither is the head or pygidium preserved. The segments of the thoracic axis are ornamented in a precisely similar manner to that seen in *R. Colbii*, except that the granules are arranged in a single row on the anterior part of each segment, and separated by a fine transverse line from the fringing tubercles on the posterior portion.

Loc. and Horizon.—Ardmillan Brae, in a fine-grained sandstone; shore at Ardwell, in a fine-grained sandstone.

Remopleurides, *sp. ind. (a)*.

(Pl. X., figs. 9, 9 a.)

Obs.—We prefer to figure the fragmentary cast represented as above separately, because it may be different from either of the foregoing, though not sufficiently complete to enable us to say much about it. The specimen consists of a portion of a flattened glabella and one eye, with the remains of the axes of three thoracic somites. The former is ornamented with granules, the latter show very distinct traces of oblique, fine, sub-imbricating laminæ, and are sprinkled with granules; but, so far as we can make out, the posterior margin of each segment is not provided with projecting tubercles, or, at any rate, by no means

to such an extent as in *R. Colbii* or *R. laterispinifer*. It is just possible that this may be only a larger condition of the form which we have identified with *R. Colbii*, to which it approaches nearest; or it may be the large form, *R. longicostatus*, Portlock; only in this "species" the glabella and thoracic somites are lamellar-striate, whilst in the present instance they are both lamellar-striate and granular.

Loc. and Horizon.—Drummuck, in a fine-grained greenish mudstone. (Gray Collection.)

Remopleurides, *sp. ind. (b).*

(Pl. X., fig. 12.)

Obs.—We may advantageously conclude this section of the genus *Remopleurides* by giving a figure of a small and imperfect specimen in which the greater portion of the glabella is preserved, and a part of the thorax. There is no trace of ornamentation either on the glabella or segments; but the structure of the eye is particularly well shown. We leave its identity an open question.

Loc. and Horizon.—Balclatchie, in a fine-grained greenish mudstone. (Gray Collection.)

The following analysis of a few of the characters of the four species of *Remopleurides* named below, taken direct from the types in their present condition, may be found of service:—

R. Colbii, Portlock.—Glabella devoid of ornamentation; thoracic segments horizontally lamellar-striate and granular, with a prominent row of spinous projections on the posterior margin of each somite; pleuræ horizontally striate—*i.e.*, parallel with their longer axes.

R. laterispinifer, Portlock.—Head, thoracic appendages, and pleuræ *apparently* devoid of ornament.

R. dorsospinifer, Portlock.—Head and thoracic segments *apparently* plain; pleuræ vertically striate—*i.e.*, striated parallel to their shorter axes.

R. longicostatus, Portlock.—Glabella lamellar-striate; thoracic segments vertically striate; pleuræ striate vertically, and obliquely outwards from their posterior margins.

Section Caphyra. Glabella with three pairs of furrows, not inflated.

R. (Caphyra) Barrandii, Eth. jun., and Nich., (*sp. nov.*)

(Pl. X., figs. 13-16; Pl. XI., fig. 16.)

Spec. char.—Head semi-oval; glabella flattened, strongly urceolate, anteriorly produced into a prominent and well-marked tongue or lip, somewhat attenuated posteriorly and indented by the eyes. There are three pairs of furrows—the basal and middle pairs almost horizontal, and at about equal distances apart; the anterior pair take their origin immediately at the anterior termination of the eyes at the base of the lip or tongue, and are directed obliquely downwards and inwards. Eyes prominent, semi-annular, forming a narrow marginal band to the large expanded portion of the glabella, extending backwards to the neck-furrow, and indenting the posterior margins of the glabella; eye-lobes linear, very minute. Neck-furrow extending all across, a little bent up in the middle line at the base of the glabella; neck-segment rather broad, obliquely striated, and without a tubercle. Wings or free cheeks elongately triangular, extending round in front of the tongue or lip of the glabella, and bordered with a small striate front margin, which is produced at the posterior angles into small, fine, short, and delicate spines. Surface of the free cheeks and glabella minutely reticulate. Thorax and pygidium unknown.

Obs.—It affords us much pleasure to name this well-marked, although small species, in honour of the indefatigable author of the section into which it properly falls from the nature of its glabella-furrows. We have been at considerable trouble in working out the affinities of *R. Barrandii*; and having availed ourselves of the descriptions and figures of all the known species (at any rate so far as we are aware), we feel justified in introducing it as undescribed, as it does not agree with any of the recorded forms.

From the Swedish species, *R. quatuorlineatus*, Angelin,¹ and *R. sexlineatus*, Angelin,² it is distinguished by its much smaller glabella, and the very great difference in the size of the anterior tongue. In the two former species this is reduced to a mere point, and at the same time the eyes are proportionately elongated, and the general form of the glabella is much more rotund.

In *R. Schlotheimi*, Billings,³ the eyes do not completely encircle the side portions of the glabella, and they do not join the neck-furrow; the direction of the glabella-furrows is also somewhat different from that seen in the Scotch form.

From *R. Panderi*, Billings,⁴ *R. Barrandii* is at once separated by the reduction of the glabella-furrows to one pair, and those of a very peculiar nature.

In *R. Canadensis*, Billings,⁵ the surface of the glabella is tubercular and not reticulate as in our form, and there is a tubercle present on the neck-segment. The position of the eyes much more closely resembles the arrangement seen in *R. Barrandii*, but the tongue is a much less marked and prominent character.

Unlike *R. Barrandii*, the Bohemian species, *R. radians*, Barr,⁶ has the surface striated, the tongue is much smaller and more elongated for the size of the Trilobite generally, and the position of the furrows in the two species differs; in the Bohemian form they are much more obliquely inclined towards one another on each side than in our species, but the place of the latter is decidedly near that of *R. radians*. The absence of furrows renders it hardly necessary to make a comparison with *R. affinis*, Billings,⁷ but the latter may be just referred to in passing, from the resemblance there is between the glabella in the two forms. We have examined a number of specimens of *R. Barrandii*, and find the characters to be constant, except

¹ Pal. Scandinavica, 1854, p. 13, f. 9, f. 8.

² Ibid., f. 7 and 7 a.

³ Pal. Foss. Canada, i. p. 294, f. 284, *a* and *b*.

⁴ Ibid., p. 293, f. 283.

⁵ Ibid., p. 182, f. 164.

⁶ Syst. Sil. Bohême, i. p. 359, Atlas, t. 43, f. 33-39.

⁷ Pal. Foss. Canada, i. p. 335.

that in one or two individuals there is a tendency in the grooves to become faint.

Loc. and Horizon.—Balcletchie, in fine-grained greenish mudstone. (Gray Collection.)

Genus ASAPHUS, Brongniart,¹ 1822.

(Hist. Nat. des Crust. Foss., pp. 7 and 17.)

Section Basilicus, Salter, 1849.

Asaphus radiatus, Salter.

(Pl. X., fig. 17.)

Asaphus (*Basilicus*?) *radiatus*, Salter, Mon. Brit. Trilobites, 1866, pt. 3, p. 157, t. 18, f. 15 (*for synonymy*).

„ „ „ Bigsby, Thesaurus Sil., 1868, p. 39.

„ „ „ Woodward, Cat. Brit. Foss. Crust., 1877, p. 26.

Obs.—Our acquaintance with *A. radiatus* as a Girvan species depends solely on the remains of the fine pygidium given in Pl. X., fig. 17. From the label attached to it, it appears to have been collected by the late A. Macallum. The anterior segment is wanting, seven only being preserved in the specimen; the terminal body, however, is quite discernible.

Loc. and Horizon.—Penwhapple burn, in a fine-grained greenish mudstone (*Coll. Mus. Pract. Geology*). This is a typical Caradoc species.

Section Isotelus, De Kay, 1824.

Asaphus gigas, De Kay(?).

(Pl. X., figs. 18, 19.)

A. (Isotelus) gigas, (De Kay) Salter, Mon. Brit. Trilobites, 1866, pt. 3, p. 161, t. 24, f. 1-5, t. 25, f. 1 (*for synonymy*).

„ *sp.* Salter, Quart. Jour. Geol. Soc., 1851, vii. p. 170, t. 8, f. 2.

„ „ Salter, Mon. Brit. Trilobites, 1866, pt. 3, p. 168.

¹ *Asaphus rectifrons* has been recorded (Mem. Geol. Survey, Scot. Expl., iii. 32) from Ardmillan Brae, but we have not been able to obtain evidence of this.

Asaphus gigas, Salter and Woodward, Chart Foss. Crustacea, f. 72.

Isotelus „ Bigsby, Thesaurus Sil., 1868, p. 56.

„ „ Woodward, Cat. Brit. Foss. Crustacea, 1877, p. 25.

„ „ Etheridge and Young, Mem. Geol. Survey, Scot., 1873, Expl. 3, p. 32.

Obs.—This species was probably first recorded as a Girvan form by Mr Salter, who mentioned the occurrence of an *Asaphus* of this section in the Girvan district contained in Sir R. Murchison's cabinet.¹ He again referred to it in his 'Monograph,' but without applying to it any distinctive name, although he considered the specimen "probably distinct from *I. gigas*."

The material at present at our disposal is meagre in the extreme—four specimens, and all in a miserable state of preservation. Having compared these with Mr Salter's figured examples of *A. (Isotelus) gigas*, we think that the interests of science will best be served, pending the arrival of fresh material, by considering the Girvan form of *Asaphus* as identical with *A. (Isotelus) gigas*. At any rate, we cannot detect any characters which would warrant more than a varietal separation being made at the best, especially with only badly-preserved material to work with. The only difference we can detect is a somewhat narrower axis to the pygidium, especially at the anterior end.

Fig. 20 (Pl. X.) is that of an *Asaphus* tail, in which the long slender axis, although much weathered, exhibits what appears to be a series of depressions on each side, in all probability resembling those represented by Mr Salter in the tail of *A. tyrannus*,² and considered by him to be internal glands.

Loc. and Horizon.—Ardmillan Brae, in a greenish mudstone (*Mus. Pract. Geology*); Balclatchie, in a similar rock. (Gray Collection.)

¹ Quart. Jour. Geol. Soc., vii. p. 170.

² Monograph, t. 22, f. 9.

Genus ILLÆNUS, Dalman, 1827.

(Palæad., p. 51).

Section Dysplanus, Burmeister, 1843.**Illænus Bowmani**, Salter.

(Pl. XI., figs. 6-8.)

Illænus (Dysp.) Bowmani, Salter, Mon. Brit. Trilobites, 1867, pt. 4, p. 185, t. 28, f. 6-13, t. 30, f. 6 (*for synonymy*).

,, ,, Bigsby, Thesaurus Sil., 1868, p. 54.

,, ,, Woodward, Cat. Brit. Foss., Crustacea, 1877, p. 40.

Obs.—It is unnecessary for us to redescribe this species after the very full manner in which it has been illustrated by the late Mr Salter.

Although a frequent species at Girvan, entire specimens are rare; disjointed heads and tails are usually met with, occasionally in a fine state of preservation. We figure (Pl. XI., fig. 6) a very neat internal cast, contained in the Gray Collection, in which the distinguishing characters of the species, so admirably laid down by Mr Salter, are well shown—the backward position of the eyes, the almost vertical facial suture, the deep punctum at the base of each axal furrow, and the distinct linear neck-furrow, visible, however, only in casts. Mr Salter states that the latter is only seen beneath the cheeks, but we find that it extends regularly across the glabella from punctum to punctum. Specimens received from Balclutchie frequently have the integument preserved; at Penkill, *I. Bowmani* is almost always in the form of internal casts, whilst in the shale connected with the Craighead limestone it is usually crushed, but, as would naturally be expected, the outer covering is in a much more satisfactory state for examination.

One of Mrs Gray's examples of *I. Bowmani* exhibits the free cheek and eye in position, although the anterior portion of the head-shield is bent down (Pl. XI., fig. 7). The eye is very well preserved, provided with a very large number of minute lenses.

Mr Salter considered the *Illænus latus*, M'Coy,¹ from the Wrae limestone of Peeblesshire, as only a compressed form of this species. The specimen, originally in the Woodwardian Museum, appears to have been mislaid, otherwise we should like to have referred to it, for we have several such depressed individuals from the Girvan area, and do not feel at all satisfied as to their identification.

If *I. latus* should prove to be identical with *I. Bowmani*, Professor M'Coy² was the first observer to point out the existence of this characteristic Trilobite in the Girvan area, otherwise Mr Salter takes precedence in this discovery.³

Loc. and Horizon.—Drummuck, in shaly beds (*Salter*); Old Fort, Kirkhill, and Penwhapple Glen (*Etheridge*⁴); Ardmillan Brae (*Etheridge*⁵) in shaly beds; Balclatchie, in a hard greenish mudstone (Gray Collection); Craighead, in the limestone (Gray Collection); Penkill, in a greenish-grey mudstone (Gray Collection); (?) as *I. latus*, M'Coy, Knockdolian Mountain to the south of Girvan (*Woodwardian Museum*).

Illænus Thomsoni, Salter.

(Pl. XI., fig. 9.)

Illænus sp. ind., Salter, Quart. Jour. Geol. Soc., 1851, viii. p. 171, t. 9, f. 3.

Illænopsis Thomsoni, Salter, Mem. Geol. Survey, 1866, iii. p. 231 (name only), non. p. 316, t. 11, b. f. 1 and 2).

Illænus Thomsoni, Salter, *ibid.*, p. 360 (name only).

„ (*Dysplanus*) *Thomsoni*, Salter, Mon. Brit. Trilobites, 1867, pt. 4,

„ p. 188, t. 28, f. 2-4, t. 30, f. 8-10.

„ „ „ Bigsby, Thesaurus Sil., 1868, p. 56.

„ „ „ (pars.) Woodward, Cat. Brit. Foss. Crustacea, 1877, p. 42.

Obs.—We figure the cast of a large caudal shield, which will bear comparison with any of Mr Salter's figured specimens. The measurements of this fine example are, length two inches

¹ Monograph, t. 22, f. 9, p. 215. ² Brit. Pal. Foss., p. 363.

³ Quart. Jour. Geol. Soc., vii. 187.

⁴ Mem. Geol. Survey, Scot., Expl. 3, 1873, pp. 30 and 32.

⁵ *Ibid.*, Expl. 7, 1869, p. 10.

six lines, and breadth two inches five lines. According to Salter, *Illænus Thomsoni* is abundant in the light-coloured sandstones of Mulloch Hill; but we have only seen a few examples, and these not in a good state of preservation. The most perfect is in the Museum of Practical Geology, and is that originally figured by Mr Salter in the Quarterly Journal of the Geological Society.

Loc. and Horizon.—Kirkhill and Girvan (*Etheridge*); Mulloch quarry (Gray Collection; *Mus. Pract. Geol.*, &c., &c.)

Illænus æmulus, Salter (?).

(Pl. XI., fig. 10; Pl. XII., figs. 12 and 13.)

Illænus (Dysp.) æmulus, Salter, Mon. Brit. Trilobites, 1867, pt. 4, p. 187, t. 28, f. 5.

„ „ „ Bigsby, Thesaurus Sil., 1868, p. 54.

„ „ „ Woodward, Cat. Brit. Foss. Crustacea, 1877, p. 40.

Obs.—The fossiliferous beds of Penkill have yielded two caudal shields and a glabella, which may belong to the form indicated by Salter under the above name. At any rate, certain of the characters assigned to *I. æmulus* are to be seen in the pygidia referred to, prominent amongst them being the strong sharp Λ -shaped plicæ, only perhaps closer and more acute than in *I. æmulus*, truncate angles, wide axial depressions, and in one of the specimens very faint indications of rings. We, however, fail to observe any trace of the posterior triangular extension of the axis. The smaller of the two specimens has attached to it nine flat thoracic rings. They may only be a variety of *I. Bowmani*, although we are induced to place them provisionally under the above, from the very marked character of the ornamentation.

The head of this species does not appear to have been described, and we therefore refer that in question to Salter's *I. æmulus* with some diffidence, chiefly on account of the presence of similar wavy imbricating undulations, although they have not the same Λ -shaped arrangement, but on the

contrary, have a more concentric appearance. The furrows were deep, and reached far forward, the glabella large and convex, the side-lobes likewise convex and somewhat arched.

Loc. and Horizon.—Penkill, in a light-coloured mudstone. (Gray Collection.)

***Illænus nexilis*, Salter.**

(Pl. XI., figs. 11-13.)

Illænus nexilis, Salter, Mon. Brit. Trilobites, 1867, pt. 4, p. 190, t. 30, f. 4 and 5.

„ „ Bigsby, Thesaurus Sil., 1868, p. 55.

„ „ Woodward, Cat. Brit. Foss. Crustacea, 1877, p. 41.

Obs.—This species was established by Mr Salter for forms of *Illænus* intermediate between *I. Bowmani* and *I. Thomsoni*, and at the time he wrote, was believed to be exclusively confined to the Girvan area; we do not know if it has been met with elsewhere, neither have we seen any specimens which we could with entire satisfaction to ourselves refer to it. We give a figure of a specimen communicated to us by Mrs Gray on behalf of a friend, which we think may be *I. nexilis*, although it is just possible *I. Bowmani* would be a more correct determination.

In his 'Monograph,' Mr Salter gave a figure¹ of a broad epistome from the cabinet of the late Lieut. Wyatt-Edgell, which he considered to be that of *I. nexilis*. Of such an epistome we give two figures (Pl. XI., figs. 12 and 13), one much larger than the other, both from Girvan. They appear to be of an elongated shuttle-like form, and to have strong, coarse, and distant transverse ridges, with deep valleys between. That they are the epistome of *I. nexilis* we do not assert, but assuming Mr Salter's figure to represent this portion of that Trilobite, the presence in Girvan beds of these shuttle-shaped epistomes lends colour to our previous determination.

¹ T. 30, f. 5 (upper figure).

Loc. and Horizon.—Mulloch quarry (*Salter*); ? Penkill, as epistomes (Gray Collection), in light-coloured mudstone.

Section Illænus proper.

Illænus Davisii, Salter.

Illænus (*Ill.*) *Davisii*, Salter, Mon. Brit. Trilobites, 1867, pt. 4, p. 194, t. 29, f. 10-16 (*for synonymy*).

„ „ Bigsby, Thesaurus Sil., 1868, p. 55.

„ „ Woodward, Cat. Brit. Foss. Crustacea, 1877, p. 41.

Obs.—*Illænus Davisii* was recorded many years ago as a Girvan species by Mr Salter,¹ who recognised it in a collection made by Mr Carrick Moore from the Stinchar river. We are not acquainted with any more recent notice of its discovery, and as the determination was made only on portions of a few body-segments, the occurrence of this species in the district under review requires confirmation.

Loc.—Stinchar river, in limestone.

Illænus Rosenbergii, Eichwald (?).

(Pl. XI., fig. 14.)

Illænus Rosenbergii (Eichw.), Salter, Mon. Brit. Trilobites, 1867, pt. 4, p. 199, t. 29, f. 2-6 (*for synonymy*).

Obs.—This Trilobite was stated to occur at the Mulloch quarry by Professor M'Coy,² but upon applying to our friend Professor Hughes, we were sorry to learn that the specimen could not then be found.

The Hunterian Museum has communicated to us, through Mrs Gray, two tails, presented by her to that institution, which we believe to be this species, and enable us to confirm Professor M'Coy's statement that *I. Rosenbergii* occurs at Girvan.

One of the pygidia in question is of an elongately oval form,

¹ Quart. Jour. Geol. Soc., v. p. 15; Decade, ii. No. 2, p. 3.

² Brit. Pal. Foss., p. 368.

with the anterior margins near the facets broken away. Mr Salter states that in the figured specimen of *I. Rosenbergii* in the Woodwardian Museum, the pygidium has "a narrow axis, defined by broad and rather deep axial furrows, which extend, however, but a short distance, and do not converge."¹ The characters of the axial furrows here described by Salter are quite those of the tail, which we think may belong to this species, now before us. On the other hand, there is no trace of the four annulations on the axis which Mr Salter states to exist in *I. Rosenbergii*. Again, the cast, according to the same authority, is marked all over "with short wavy impressed lines and puncta." In our specimen, which is also a cast, the lines are absent, but the puncta are present in quantity and well marked. On the whole, therefore, if the identification with the Trilobite, which Salter referred to *I. Rosenbergii*, Eichwald, is not as close as it might be, nevertheless we have the remains of an individual partaking of many of its characters, and probably indicating an allied species at least.

The Craighead limestone has furnished us with a glabella, which appears to be of too elongated and oval a form to be that of *I. Bowmani*, and may, perhaps, be the head of the species whose tail has just been described. We cannot detect any trace of the characteristic neck-groove and depressions at the base of the glabella-furrows of the former species.

Loc. and Horizon.—Mulloch quarry (M'Coy, Woodwardian Museum). ? Craighead, in the limestone. (Gray Collection.)

Illænus crassicauda, Wahlenberg (?).

Ill. crassicauda (Wahl. ?), Salter, Mon. Brit. Trilobites, 1867, pt. 4, p. 215, f. 56.

Obs.—Both Professor M'Coy² and Mr Salter refer to this as a Girvan species, but the latter with doubt; we are not able to afford any further information.

Loc.—Knockdolian, south of Girvan (*Woodwardian Museum*).

¹ Monograph, p. 200.

² Brit. Pal. Foss., p. 354.

Illænus Murchisoni, Salter (?).

(Pl. XII., fig. 1.)

Ill. Murchisoni, Salter, Mon. Brit. Trilobites, 1867, pt. 4, p. 201, t. 26, f. 1,
t. 30, f. 7.

„ Bigsby, Thesaurus Sil., 1868, p. 55.

„ Woodward, Cat. Brit. Foss. Crustacea, 1877, p. 41.

Obs.—The evidently rare occurrence of a very large Trilobite at Girvan has induced us to figure the imperfect tail represented on Pl. XII., fig. 1. It measures two inches one line in one direction, by three inches in the other; and is an internal cast with the whole of the integument removed except at one or two spots on the surface. The caudal fascia is moderately broad and prominent, and marked with strong, coarse, imbricating ridges, which in casts show well upon the abruptly bent down margin.

We are quite unable to refer this fine specimen to any other species than *Illænus Murchisoni*. It will be observed that the anterior part of the axis and the pleural facets have been broken off, which gives it a rather deceptive appearance; but when we take into consideration the characters previously mentioned, and compare them with Mr Salter's figure, the resemblance is seen to be very close. Mr Salter mentions that the fascia in *I. Murchisoni* is narrow; this must be an oversight, because in his figure it is represented as anything but in this condition.

A second pygidium from the same locality as the foregoing may perhaps be referable to this species also, but of this we are not so confident. It is much compressed, the fascia is not well seen, and the pleural facets are perhaps too obliquely reflected. On the other hand the surface of the cast is granular, a character assigned by Salter to *I. Murchisoni*.

Loc. and Horizon.—Penkill, in a fine light-coloured mudstone. (Gray Collection.)

Illænus Macallumi, Salter.

(Pl. XII., fig. 2.)

Illænus Macallumi, Salter, Mon. Brit. Trilobites, 1867, pt. iv. p. 210, t. 28, f. 1, t. 30, f. 2 and 3.

Obs.—We figure a cast of a tail of this species from the typical locality, but are otherwise unable to advance the description of the species as a whole. The general convexity, prominent fulcra, and recurved margin, are well shown in this example.

There is also a head which may be that of this species, as it possesses a blunt front-edge, the furrows apparently curving round the eyes, and a central glabella-ridge; but as it is very imperfect and appears to have been more or less crushed, we leave its position an open question.

Loc. and Horizon.—Mulloch Hill in a dark-greenish mudstone or fine sandstone (Gray Coll.); Kirkhill (*Coll. Mus. Pract. Geol.*)¹

Genus BRONTEUS, Goldfuss, 1839.

(Nova. Act. Phys. Med. Acad. Cæsareæ Leop.-Carol. Nat. Curios, xix. pt. 1, p. 360.)

Bronteus Andersoni, Etheridge jun., and Nicholson (*sp. nov.*)

(Pl. XII., figs. 3-5.)

Spec. char.—Head (so far as preserved) depressed; glabella strongly club-shaped; frontal lobe overhanging the others; axial furrows well marked, biconcave towards one another; fixed cheeks not well preserved; anterior margin small but prominent, ornamentation consisting of faint partially imbricating (?) concentric lines.

The thoracic axis is rounded and convex; the pleuræ hori-

¹ Cat. Camb. and Sil. Foss. Mus. Pract. Geol., 1878, p. 63. (The specimen figured by Salter, Monograph, t. 28, f. 1.)

zontal and flattened, their terminal portions deflected, wrinkled transversely; ten or eleven segments.

Pygidium more or less semi-oval, longer than wide, not much attenuated posteriorly, surface a little vaulted. Axis well marked, consisting of an inner and two small side-lobes, separated by longitudinal faint grooves; it is as a whole very small for the size of the tail, and short as compared with the length of the latter; the central lobe is subdivided by seven (?) transverse grooves, whilst the side-lobes are small and linear. The lateral portions of the tail are subdivided into seven sharp, angular, radiating ridges on each side, corresponding with the subdivisions of the central lobe of the axis. The median line of the tail, forming the posterior continuation of the latter, consists of a sharp, angular, undivided ridge. The general surface is depressed, and for about one-half its width round the axis is flat, thence to the margin slightly and feebly concave. When the integument is removed, this concavity is seen to be ornamented by close, undulating, concentric, and imbricating (?) striæ, or laminæ, which became less undulating as the margin is receded from.

Obs.—Unfortunately we are not able to give the characters of the head and thorax with as much detail as those of the tail, the preponderance of the remains of the latter over those of the former being something remarkable. It is by no means an uncommon species at one locality. The segmentation of the central lobe of the pygidium in the genus *Bronteus* appears to be confined to a few species, and the discovery of a form possessing this character in the Girvan rocks is interesting. This axial segmentation is discernible only in a few specimens, the nature of the matrix being such that the finer and more delicate characters are obliterated, but in one or two of the specimens in question it is distinctly exhibited. The ornamentation of the tail is a very well-marked feature in this species; but all the *Brontei* so closely resemble one another in this respect that it is of less importance.

In comparing *B. Andersoni* with other species we shall con-

fine ourselves to those in which the central lobe of the axis is segmented, a proceeding which will lessen in a great degree the difficulties of identification and place the matter within a tolerably narrow compass.

The specific numerical strength of the genus *Bronteus* in British rocks is very limited. We have *B. Hibernicus*, Portlock; *B. signatus*, Phill; *B. laticauda*, Wahlenberg; and *B. flabellifer*, Goldfuss. With the two last-named we do not consider it necessary to compare our Girvan form. As regards *B. Hibernicus*, so little has been written that we hardly know how to enter on a comparison, Portlock's figures being undoubtedly those of imperfect specimens; but of *B. signatus* a more definite opinion can be expressed. In the type-specimen of the former, now in the Museum of Practical Geology, the axis of the tail is unsegmented. This, if a permanent character, would at once distinguish it from the Girvan individuals. Again, the lobes are very indistinctly marked, and it is of much greater size than *B. Andersoni*, which, amongst a large number of specimens, retains the same proportions with great regularity, and is, also, not tuberculated.

With regard to *B. signatus* of the Devonian rocks, we find that it possesses a much less number of radiating costæ, and the trilobation and segmentation of the axis are again very indistinct. By some authors this species is considered identical with *Bronteus laticauda*, Wahlenberg.

Of the large number of species of *Bronteus* described by M. Barrande, in the 'Système Sil. de la Centre de la Bohême,' only two require detailed consideration at our hands: these are *B. planus*¹ and *B. simulans*.² In the first, the central lobe of the axis of the pygidium has from three to four transverse grooves, whilst in the second there are four or five. A reference to our specific description will at once show the difference which exists between *B. Andersoni*, (*nobis*), and the two species just mentioned. In the Girvan form, there are seven distinct segments present, which we consider a suffi-

¹ *Loc. cit.*, i., Atlas, t. 42, f. 34.

² *Ibid.*, t. 48, f. 33.

ciently well-marked difference to warrant us in separating it from the foregoing.

In *B. Barrandii*, Hall,¹ the axis of the tail is transversely subdivided by two distinct articulations, and the same number is recognisable in that of *B. occasus*, Winchell and Marcy.²

We have expended some time in referring to all the descriptions of *Brontei* within our reach, but we have not met with any one with which our species could be satisfactorily identified: those just cited are the nearest.

It affords us much pleasure to name this species in honour of the late Mr Thomas Anderson of Girvan, an intelligent and enthusiastic collector, whose assistance in the collection of the material for this 'Monograph' we desire to acknowledge.

Loc. and Horizon.—Tolerably abundant in the greenish-grey mudstones of Penkill (Gray Collection); Ardmillan Brae as *Bronteus hibernicus*. (*Coll. Mus. Pract. Geol.*)³

Bronteus, sp. ind. (a).

(Pl. XII., fig. 6.)

Obs.—The limestone of Craighead has yielded a single specimen of a large species of *Bronteus*, clearly distinct from the last. When complete, the pygidium was probably of an oval form, and had narrow, rounded, and prominent or cord-like radiating ridges on the side-lobes, leaving between them broad, flat, or very slightly concave interspaces. The concentric striæ, almost partaking of the nature of imbrications, are not undulate, but, apparently, regular and direct. Of the form and characters of the axial lobe, we are quite ignorant. In size, strength of the radiating ridges, width of the interspaces, and general appearance, this fragmentary fossil very closely resembles the type-specimen of *Bronteus hibernicus*, Portlock.

¹ Pal. N. York, iii., Atlas, t. 73, f. 1-4.

² 'Enumeration of Fossils collected in the Niagara Limestone at Chicago,' Mem. Boston Soc. Nat. Hist., i. p. 104, t. 3, f. 11.

³ Mem. Geol. Survey Scotland, Expl. No. vii. p. 32. We have examined the specimen upon which this determination was made.

Loc. and Horizon.—Limestone at Craighead. (Gray Collection.)

Bronteus, *sp. ind. (b).*

Obs.—A small pygidium, of which we possess only two specimens, deserves notice, as it appears to be different from either *B. Andersoni* or the species indicated above. In form the tail is semicircular, gently convex over the whole surface, and the lateral ridges almost obliterated. We hope to obtain further material.

Loc. and Horizon.—The limestone of Craighead. (Gray Collection.)

Genus BRONTEOPSIS, Wyv. Thomson, 1857. (*Gen. nov.*)

Bronteopsis, Wyv. Thomson, 1857, MS. (*vide* Salter).

„ Salter, 1866, Mon. Brit. Trilobites, pt. 3, p. 143.

„ „ 1867, Ibid., pt. 4, p. 216.

Obs.—In describing *Barrandia Cordai*, M'Coy, the late Mr J. W. Salter wrote as follows: "The passage from the *Ogygides* to the *Bronteidæ* is rendered still more easy by a MSS. genus, *Bronteopsis*, distinguished so far back as 1857 by my friend Prof. Wyville Thomson, who was at that time carefully studying the Caradoc fossils of the Girvan district. The genus is a very remarkable one, having all the characters of the *Bron-teidæ*, and will be described under that family. But the crust appears to have been thin, not calcareous; and the habit of the tail is so much that of *Barrandia*, that it might well be mistaken for an extreme member of the group we are describing." We have had the good fortune to discover in the private portion of the collection of the Museum of Practical Geology, specimens bearing the label, "*Bronteopsis Scotica*, Salter MS.," and collected in the Girvan district by the late Mr R. Gibbs. We have no reason to doubt that these are the original specimens used by Mr Salter, in conjunction with those in Sir Wyville Thomson's Cabinet, at the time he wrote the above passage.

They have enabled us to name correctly a numerous suite of specimens in the "Gray Collection," which we should otherwise have referred to *Barrandia* with doubt,—an excusable error after Mr Salter's remark above quoted.

The only other information relating to *Bronteopsis*, given by Mr Salter, are a few remarks contained in his introductory notice to the family *Bronteidæ*. He says, speaking of the pygidium: "This is not usually a part of much consequence in classification; but by tracing the variation of the tail-piece in *Bronteus*, through *Bronteopsis* to *Barrandia*, the relations of the group to *Ogygia* are clearly seen." Again, he adds, "The shape and lobes of the glabella are much like those in *Barrandia*; and, as before said, the shortened tail-axis of the last genus points to the still shorter axis in *Bronteopsis*, and the almost obsolete one in *Bronteus*." We refrain from giving a concise generic definition of *Bronteopsis* at once, and content ourselves with as full a description as possible of the only species at present known,—since the former can be added when we are better acquainted with the characters of a more extended series of species.

***Bronteopsis Scotica*, Salter (*sp. nov.*)**

(Pl. X., figs. 21 and 22; Pl. XI., figs. 1-5.)

B. Scotica, Salter, MS., Coll. Mus. Pract. Geology.

Spec. char.—Entire head unknown. Glabella clavate, triangular; forehead-lobe insensibly expanded in front towards the front margin, which is bordered by a striated rim; the glabella is narrowed behind, and within the posterior half is a central obtuse median ridge; on each side of the latter are three circular shallow depressions, arranged in opposite pairs and answering to the facial grooves; axal furrows well marked in their posterior course, but gradually becoming obsolete towards the anterior margin of the head. Cheeks narrow, with an outer sigmoidal margin. Neck-furrow shallow and inconspicuous; neck-segment narrow, angular, but little raised above the general surface. Facial suture elongately-sigmoidal, terminating at a

point on the posterior margin almost opposite that at which it cuts the anterior margin. Anterior part of the forehead-lobe delicately lineate; epistome, or rostral shield, longitudinally imbricate-striate; labrum convex, wide on the side of attachment, narrow and round towards the posterior, concentrically lineate.

Thorax of seven or eight segments, of much less width than the tail; axis convex, of nearly equal width to the pleuræ. The latter are horizontal, without grooves, but each with a central angular ridge dividing it into two almost equal portions.

Pygidium large, semicircular, with the angles rounded, but at the same time faceted, and a shallow, concavely-flattened limb. Axis flattened, narrow and very short, of five small segments, and a large projecting terminal appendage. Side-lobes gently rounded, with five or six indistinct rounded pleuræ on each side, which extend as far as the termination of the declivity, but do not impinge on the limb; the four anterior ribs always more distinctly marked; fulcra rather prominent. General crust very thin.

Obs.—The structure of the glabella-grooves, or furrows, represented in *Bronteopsis* by the shallow pits along the sides of the glabella, indicates a transition towards *Ogygia*. This resemblance is, however, not borne out by the few-ringed thorax with its grooveless pleuræ, nor by the very short axis of the pygidium, and the entire pleuræ or side-lobes of the former. The characters of the tail are more those of *Barrandia*, with a tendency towards *Bronteus*; but, again, the grooved thoracic pleuræ of the former separate it quite from *Bronteopsis*.

The form of the glabella, course of the facial suture, and number of thoracic somites, the grooveless pleuræ, and the abbreviated axis of the pygidium, clearly separate *Bronteopsis* from *Asaphus*.

On the other hand, the broad large forehead-lobe, the position of the pits on the sides of the glabella, the narrow fixed cheek, the grooveless pleuræ, and the large semicircular

tail, with its abbreviated axis, clearly justified Mr Salter in placing this genus near *Bronteus*. It must, however, be borne in mind that we have only, at present, been able to ascertain the existence of seven or eight, instead of ten, thoracic somites, and we know nothing about the eyes.

The free cheeks are unknown to us with any certainty, although we have from the same bed yielding the other portions of *B. Scotica*, a fragment which may represent the part in question.

Occurring with the remains of *Bronteopsis Scotica* are several small pygidia, which, when we know more of the genus, it may be necessary to separate as a species distinct from the type; for the present, however, we prefer to regard them as the young condition of the same. (Pl. XI., fig. 5.)

We question if the small specimens in the Museum of Practical Geology, on which the occurrence of *Stygina latifrons* in the Girvan district has been based, are more than badly-preserved examples of the young form just referred to.

Loc. and Horizon.—Penwhapple Glen, in a greenish fine-grained mudstone (*Mus. Pract. Geology*); Balcletchie, in a similar rock. (Gray Collection.)¹

Genus PROETUS, *Steininger*, 1831.

Section *Forbesia*, M'Coy (1846), 1862.

(Glabella-furrows present; neck-segment terminated on each side by a tubercle or small node; and posterior angles of the cephalic shield produced into spines.)

Proetus Girvanensis, Eth. jun., and Nicholson (*sp. nov.*)

(Pl. XII., figs. 7-10.)

Spec. char.—Oblong-oval, robust, the anterior and posterior

¹ It is probable that these two localities are one and the same.

extremities rounded ; general axis prominent, gradually tapering towards the posterior margin. Cephalic shield semicircular, being the most convex portion of the body ; longer than the tail, but of less length than the thorax ; the glabella and cheeks when in apposition forming a well-marked arch. Glabella short, almost square, with the angles rounded off, a little broader behind than in front, lateral margins but very little concave ; very blunt in front, not quite reaching the anterior margin ; of equal width with the cheeks. Front margin concave, bent up in front, not impinged on by the glabella ; when seen in internal casts, with the integument removed, the concave margin is delicately striate as far back as the posterior angles. Furrows of the glabella very indistinctly marked. Neck-furrow broad, and deep at the base of the glabella, as broad but shallower below the free cheeks. Neck-segment broad, and well marked, with a central papilla ; the lateral tubercles flattened and somewhat elongated in outline, inconspicuous. Fixed cheeks small and linear. Eye-lobe projecting from the small fixed cheeks. Free cheeks obtusely triangular, produced posteriorly into short, tapering, pointed, genal spines, extending as far as the third, or perhaps the fourth, thoracic somite. Eyes close to the sides of the glabella, small and very prominent, subreniform or almost rotund, microscopically faceted (in internal casts). Facial sutures in front of the eyes, curving gradually, bent outwards ; behind the eyes, almost vertical till near the neck-margin, when they turn sharply outwards for a short distance, and cut the posterior margin. Surface of the glabella concentrically lined. Thorax of ten segments, one and a quarter as long as the head. Axis quite as broad as the pleuræ, convex, rounded, gradually tapering ; marginal tubercles moderately well developed, although not very prominent. Pleuræ throughout their course preserving about the same convexity as the free cheeks. The axis-segments are ornamented with a row of papillæ, or minute tubercles on each, in the central line, and are always obliquely striated.

Pygidium about half the length of the thorax, broad-oval ;

axis convex, well marked, not reaching to the posterior margin or limb, but connected with it by a slight ridge; of five segments and a broader terminal process. Side-lobes flattened, the segments four or five in number, much more indistinctly marked than on any other part of the body; limb striated concentrically (in casts).

Ornamentation of the whole test or integument not preserved, but on the internal casts of the cheeks there is a microscopic pitting or reticulation present.

Obs.—The present species occurs somewhat plentifully at Drummock, numerous well-preserved internal casts, and here and there a specimen with the test remaining, being in the collections of Mrs Gray, the Museum of Practical Geology, and the Geological Survey of Scotland. Notwithstanding the large number of *Proeti* which have been described from the Palæozoic rocks generally of the European and American continents, we believe we are justified in regarding the present one as new.

From *Proetus* (*Forbesia*) *latifrons*, M'Coy,¹ it is distinguished (1) by the difference in the form of the glabella, the latter being in the Girvan form relatively much shorter in proportion to its breadth, with less indented lateral margins, wider base, and much less attenuated anterior extremity; (2) by a lessening of the space between the glabella and the anterior margin of the head-shield; (3) by the smaller, more prominent, and less reniform eyes; (4) by the absence of the notch in the front margin of the head-shield; (5) by the proportionately wider, but shorter, and more triangular cheeks; (6) by the much greater disproportion between the sizes of the head, thorax, and pygidium (in *P. latifrons*, the head and body are equal, while here the body is nearly the width of three segments longer than the head); (7) by the diminished number of segments on the axis of the tail and side-lobes.

Proetus Stokesii, Murchison,² has a much more pointed cephalic shield, and the genal spines appear to extend back-

¹ Synop. Sil. Foss., Ireland, p. 49, t. 4, f. 11.

² Sil. System, t. 14, f. 6.

wards to the commencement of the pygidium, characters at once quite sufficient to separate it from *P. Girvanensis*.

Of the many forms of *Proetus* described by Barrande from the Silurian rocks of Bohemia, our species does not appear to be identical with one. In some one, or perhaps two or three characters, it agrees with several of the latter, but there exist in conjunction strong points of departure from any one of these. *P. Girvanensis* differs from some of the Bohemian species in the form and size of the glabella; the distance of the front of the latter from the anterior margin; the size, shape, and position of the eyes; the width of the thorax and the degree of segmentation of the tail; the nature of the limb of the latter; and the number of the thoracic somites. As examples of the manner in which our species differs in the form and size of the glabella, and its distance from the front margin, we may mention *Proetus superstes*, Barr; *P. Ryckholtii*, Barr; *P. unguloides*, Barr; *P. micropygus*, Barr; *B. ascanius*, Barr; and many others.¹ As regards the size, shape, and position of the eyes, *P. myops*, Barr,² may be taken as illustrating the difference which exists between the eyes of our form and the majority of the Bohemian species. The dissimilarities present in the limb of the tail and in the nature of the pleuræ are exhibited by *P. Archiaci*, Barr;³ *P. striatus*, Barr;⁴ and *P. Lovéni*, Barr,⁵ respectively. Several of the Bohemian species have the peculiar ridge extending from the last axis-segment of the pygidium to the limb, as *P. venustus*, Barr; *P. decorus*, Barr; and *P. natator*, Barr. On the whole, we can merely say that there is a general resemblance to many of the Bohemian forms, especially of the type with a broad-fronted glabella, such as *P. Bohemicus*, Barr, without any absolute identity,—indeed in nearly every case there is to be found some strong point of divergence. We have compared our specimens with examples of *P. Bohemicus*, Barr, in the British Museum, and we find that in this species the glabella is proportionately

¹ Syst. Sil. Bohême., i. t. 15.

³ Ibid., t. 17, f. 42.

⁴ Ibid., t. 17, f. 46.

² Loc. cit., t. 15.

⁵ Ibid., t. 17, f. a and b.

narrower in front, and wants the wide anterior margin in front of it.

From the Swedish species *P. (Calymene) concinnus*, Dalman,¹ the Girvan form is easily distinguished by the outline of the glabella and cheeks, and the form and position of the eyes. In addition to the foregoing comparisons, we have referred to the descriptions of a large number of American species described by various authors. With the *P. corycæus*, Hall,² and *P. protuberans*, Hall,³ *P. Girvanensis* has no characters of importance in common, whilst the general outline, and brevity of the cephalic spines, distinguish it from *P. Spurlockii*, Meek.⁴ Two species have been described from Missouri, by Professor Shumard,⁵ *P. Swallowii*, and *P. Missouriensis*. The first has no cephalic spines, and the general form of the head and glabella is different; whilst in the second, although the squarer form of the glabella reminds us of the structure of the Girvan species, there are large basal lobes present, which point more towards the genus *Cyphaspis*, and which are not present in our form.

In the "Fifteenth Annual Report" on the State Cabinet of Natural History of New York, Professor James Hall has described no less than fifteen American species of this genus, many of them undescribed at the time he wrote. We have carefully studied these descriptions, but as they are unaccompanied by figures it is almost impossible to definitely point out how they differ from our species, especially in a genus like *Proetus*, where the species all closely run into one another, although we are strongly convinced that *P. Girvanensis* is distinct from them all.

We have reserved until the last any remarks upon several indicated although unnamed species by the late Mr Salter, more especially as it is to one or other of these that our

¹ Öf Vet. Akad. Handl., 1826, t. 1, f. 5 and 6.

² Hall. Pal. N. York, ii. t. 67, f. 15.

³ Ibid., iii. t. 73, f. 5-8.

⁴ Ohio Geol. Report, i. pt. 2, t. 14, f. 12.

⁵ 1st and 2d Ann. Report, Geol. Survey, Missouri, 1855, t. 13, f. 12 and 13.

Girvan form is most nearly allied. The anterior third of one of the species in question, from the Wenlock limestone, has been beautifully figured in the Memoirs of the Geological Survey,¹ and in the quadrate form of the glabella is undoubtedly a close ally of our examples from Girvan. It is, however, to be remarked that in this form, which is a small one, the eyes are unusually large for its size, and the neck-tubercles are very pronounced, as against the small eyes and ill-defined tubercles in *P. Girvanensis*.

In the Woodwardian Museum Catalogue of Cambrian and Silurian Fossils,² Mr Salter gave figures of one or two species of undescribed *Proetus* which, to a certain extent, resemble our *P. Girvanensis*; but there is, again, noticeable the very marked difference in the form and size of the free cheeks.

In the figures we give of this species may be noticed a slight variation in one or two of the characters which distinguish it. Thus, fig. 7 is of a somewhat more oval form than the others; again, in fig. 7, the free cheek appears to be a shade wider than in figs. 9 or 10; but beyond such trivial points there appears to be little or no reason for considering all of them as other than one species.

Loc. and Horizon.—Drummuck, in a fine greenish sandstone or mudstone (Gray Collection; *Mus. Pract. Geol.; Coll. Geol. Survey, Scot.*); Lady Burn, above Drummuck (*Mus. Pract. Geol.*)

Proetus procerus, Etheridge jun., and Nicholson (*sp. nov.*)

(Pl. XII., fig. 11.)

Spec. char.—Elongately oval, slender, gradually tapering towards the posterior margin; head and thorax equal in length; tail less than half the length of either. Cephalic shield semi-oval, breadth a little exceeding the length; glabella square-oval, longer than broad, a little wider behind than before; axial furrows well marked, slightly concave at the sides of the

¹ Vol. ii. pt. i. pl. 6, f. 2.

² Cambridge, 1873, pp. 133, 134, &c.

glabella; furrows not visible; surface gently convex, most so immediately in front of the neck-furrow; front margin as wide or wider than the neck-furrow and segment combined. Fixed cheeks inconspicuous, the eyes situated close to the axial furrows in the before-mentioned concavities of the latter. Facial suture sharply deflected outwards in front of the eye, behind it almost vertical for a short distance, then gradually turning outwards at an obtuse angle to cut the posterior margin at a point nearer the genal angles than the axial furrows. Eye small, projecting but very little outwards laterally, and not extending either backwards or forwards to any great extent. Neck-furrow well marked, not as broad as the segment; basal lobes inconspicuous. Free cheek irregularly triangular; genal angles produced into spines, extending as far back as the third thoracic somite.

Thorax of ten somites, gradually tapering posteriorly; axis very coarse and round, separated from the pleuræ by strong axial furrows (in the cast), and wider than the pleuræ; the latter are arched in the middle line and sharply bent down distally.

Pygidium small, with a tapering, convex, raised axis of five segments and a terminal appendage. On the side-lobes the pleuræ are almost obsolete, being represented by a few faint radiating markings.

Obs.—The small eye, large free cheek, and prominent axis of the thorax in *P. procerus* closely ally it to *P. Girvanensis*; but when the slender elongated form of the one is compared with the robust and round outline of the other, we do not see how it would be possible to unite the two forms under one specific name. Furthermore, in *P. Girvanensis* the axis and pleuræ of the thorax are of the same breadth, whereas in *P. procerus* the axis is wider than the pleuræ. Neither can the present species be referred to either of the British described *Proeti*, *P. latifrons*, M'Coy, or *P. Stokesii*, Murchison, from both of which it differs in many essential particulars, chiefly, however, in the size of the eye and the slender elongated form.

So far as we have been able to make an examination, it is not identical either with any of the numerous manuscript species which have crept into print from time to time. We do not think it necessary to enter into details of comparison with the array of species noticed under the description of *P. Girvanensis*, for almost the same characters mentioned as separating the latter from these species will suffice in the present instance, except, of course, those points just now indicated as marking the line of demarcation between *P. procerus* and *P. Girvanensis*.

Loc. and Horizon.—Drummuck, in a fine-grained greenish sand or mudstone. (Gray Collection.)

Genus AMPYX, Dalman, 1827.

(Kongl. Vet. Acad. Handlingar för år 1826, p. 252.)

Obs.—Dalman proposed the name *Ampyx* as a section of *Asaphus*, but as M. Barrande has remarked, its "characters are so distinct from those of *Asaphus*, that the generality of palæontologists who have followed have not hesitated to consider this type as separate."¹ The characters assigned by Dalman to *Ampyx* were the absence of eyes, large triangular head, non-lobate prominent glabella, 6-segmented thorax, and distinct undivided pygidium.

In 1849 Professor Ed. Forbes² proposed the subdivision of *Ampyx* into two provisional sections :—

1. *Ampyx* proper, with the head long, and five somites to the thorax.
2. *Brachampyx*, Forbes, 1849, with the head short and round, and six somites to the thorax.

Following Professor Forbes, Dr Angelin, in 1854,³ proposed the subdivision of his family *Raphiophoridae* into three genera :—

¹ Syst. Sil. Bohême., i. p. 632.

² Mem. Geol. Survey Gt. Brit., Dec. 2, pt. 10, p. 3.

³ Pal. Scandinavia, p. 80.

1. *Lonchodomus*, Angelin, 1854, with a lanceolate glabella, terminating in an elongated prismatic spine. Type, *L. (Ampyx) rostratus*, Sars.
2. *Ampyx*, Dalman, with an oval glabella, terminating in a round spine ; six thoracic somites. Type, *A. costatus*, Boeck.
3. *Raphiophorus*, Angelin, 1854, with an obovate glabella, having an abrupt apical spine ; five thoracic segments. Type, *R. setirostris*, Angelin.

In 1852, M. Barrande,¹ writing anteriorly to Dr Angelin, subdivided *Ampyx* into three groups, but he did not assign names to them. *Group 1*, with six thoracic segments ; *Group 2*, with five thoracic segments ; *Group 3*, thorax unknown.

If we now compare the subdivisions proposed by Forbes and Angelin, we at once meet with a slight overlapping in their respective sectional names. Angelin retained the term *Ampyx* almost in the sense of its originator, Dalman, for types with six thoracic segments, his two other sections differing from this in possessing five such somites, but unlike one another in the form of the head. We feel that this will be looked upon as a sound and philosophical course on the part of Dr Angelin. On the other hand, Professor Forbes proposed his provisional *Brachampyx* also for forms with six body-rings, from which it becomes evident that *Brachampyx*, Forbes, is equivalent to, at least, *Ampyx*, Angelin. Now, as we consider, in this matter of creating sub-genera or sections of genera, that the section represented by the original name of the author should correspond as nearly as possible to that author's definition, it seems to us that the term *Brachampyx* is altogether misplaced and should be abandoned ; on the ground that, although anterior in date to the section *Ampyx*, Angelin, the latter is essentially *Ampyx*, Dalman. In this case Forbes's first section, or *Ampyx*, Forbes, is equivalent to *Lonchodomus*, Angelin, or *Raphiophorus*, Angelin, or perhaps to both combined, and also to Group 2 of M. Barrande.

In the succeeding pages we shall adopt the genera of Angelin's *Raphiophoridae* in the sectional sense, as used by Mr Salter throughout his 'Monograph.'

¹ Syst. Sil. Bohême, i. p. 636.

Section *Lonchodomus*, Angelin, 1854.

***Ampyx rostratus*, Sars.**

(Pl. XII., figs. 14 and 15 ; Pl. XII., figs. 1-3.)

Ampyx rostratus, Sars, Oken's Isis., 1835, heft 4, p. 334, t. 8, f. 3 *a c.*

„ „ M. Edwards, Hist. Nat. Crust., 1840, iii. p. 296.

„ *Sarsii*, Portlock, Geol. Report, Londonderry, &c., 1843, p. 260, t. 1, f. 9 and 10.

„ *rostratus*, Bronn, Index Pal. Nomen., 1849, p. 69.

„ „ Morris, Cat. Brit. Foss., 1854, 2d ed. p. 99.

Lonchodomus rostratus, Angelin, Pal. Scand., 1854, p. 82, t. 40, f. 11 *a-d.*

Ampyx rostratus, Bigsby, Thes. Sil., 1868, p. 36.

„ „ Steinhardt, Beitr. Naturk. Preus. Physik-Ökonomischen, Gesellschaft, Königsberg, 1874, 3, p. 39, t. 4, f. 10, ? t. 5, f. 7.

Lonchodomus rostratus, Lindström, in Angelin's Pal. Scand., 2d ed., 1878, p. 82, t. 40, f. 11.

Spec. char.—General form oval, produced anteriorly. Cephalic shield triangular; glabella long, oval, diamond-shaped, contracted anteriorly and posteriorly; widest and most convex about the middle, the anterior extremity terminating in a long spine, the posterior margin reaching quite to the neck-furrow, the anterior third projecting freely from the remainder of the head, and snout-like; in some individuals the central line of the glabella is ridge-like or occupied by a narrow, elongated, flattened area. Glabella-furrows represented by pits along the posterior lateral margins of the glabella. Two of these are situated at the base on opposite sides, a little in front of the neck-furrow, and in a measure mark off the base of the glabella as an indistinct lobe, their longer axes being transverse to that of the glabella; two others, having an oblique inclination, are situated at the anterior ends of the axal furrows, at the anterior junction of the outline of the glabella and fixed cheeks; two more, one on each side, are placed a little above these, but with their longer axes parallel to that of the glabella. Free cheeks triangular, with the outer margins more or less sigmoidal. Axal furrows not strongly marked. Neck-furrow faint, except at the outward termination of the fixed cheeks, where it is deeper on each

side; hardly perceptible under the base of the glabella. Free cheeks small, their outer margins rounded, the inner sigmoidal, terminating posteriorly in inwardly-curved produced spines. The anterior and genal spines are prismatic in section, with the four faces more or less concave; the former projects from the head almost in the same plane with the body, or is parallel to its longer axis. Facial suture elongately sigmoidal, cutting the anterior margin about half-way between the axial furrows and the genal angles, and the posterior margin close to the latter. Rostral shield, and incurved under margin, widely V-shaped; the latter is concave with ridge-like borders. Surface of head (in casts) punctate. Thorax short and broad. The axis is equal in length to the pygidium, but much less than the glabella; wider than the pleuræ, slightly convex. Pleuræ flattened.

Pygidium semicircular, with a broad, bevelled, and striated limb. Axis faintly segmented, with a row of tubercles on each side, with the exception of the first segment which is distinct; lateral lobes undivided, except for an anterior furrow on each side corresponding to the anterior somite of the axis.

Obs.—The above are the characters of the British specimens referred to *A. rostratus*, Sars. The latter and Milne-Edwards describe the axis of the pygidium as possessing six rows of tubercles. This is quite possible, because the tails which have come under our notice are casts, and not in a good state of preservation, although we have one example in which five are visible on one side, and this character might easily be obliterated.

The pits along the sides of the glabella which we have described above, are not visible in all the specimens before us, but are particularly well seen in one which we figure. In all, however, there is more or less a trace of them to be found, and especially of the most anterior and lowest pairs.

The form of the head in this species is very characteristic, and were the sides prolonged from the genal angles to the base of the rostral spine, an almost equilateral triangle would be

formed. As a British species, the occurrence of *Ampyx rostratus* is limited ; as we are acquainted only with specimens from the typical Irish locality, a very doubtful specimen from Garn in Wales, referable to the Llandeilo, examples probably belonging to this form from the Coniston Limestone of Keisley, Westmorland, and the present examples from Girvan.

Loc. and Horizon.—Drummuck, in a fine-grained greenish sandstone or mudstone (Gray Collection ; and *Mus. Pract. Geology*) ; Lady Burn above Drummuck (*Mus. Pract. Geol.*) ; Littleburn, south-west of High Mains (*ibid.*)

***Ampyx Macallumi*, Salter (*sp. nov.*)**

(Pl. XII., figs. 9-12.)

A. Macallumi, Salter, MS., Cat. Foss. Mus. Pract. Geol., 1865, p. 18.

Spec. char.—Cephalic shield almost an equilateral triangle. Glabella lanceolate-triangular, arched, with a sharp dorsal ridge which terminates anteriorly in an attenuated spine ; backwards the glabella terminates against the neck-furrow with a narrow truncated base ; furrows or depressions not visible, except the anterior pair, which are situated exactly at the middle angles of the glabella. Fixed cheeks acutely triangular, their outer margins extending from the neck to the anterior end of the glabella, or, as it might be termed, the narrow neck of the spine, and so enclosing the whole of the former within their boundaries ; surface slightly convex or almost flat in those portions next the glabella, becoming a little bent down towards the facial sutures. Glabella-spine short, spine-like, prismatic, or triangular (?), grooved. Neck-furrow linear, only an impressed line, inconspicuous below the glabella. Neck-segment broad, sloping inwards towards the head. Free cheeks unknown. Facial sutures direct, a little indented about the middle of their course. Ornamentation none.

Thoracic somites, five in number, short and broad ; axis very gently convex, pleuræ flat ; axal grooves faintly marked. Each pleura is unequally divided into an anterior and posterior

portion, the former being the largest, by a shallow pleural groove, which, commencing at the distal or outer end of the pleuræ, gradually dies out before reaching the axis, in a very marked manner.

Pygidium semicircular, with a striated or slightly-bevelled limb; axis very gently convex, with the first segment strongly differentiated; side-lobes flat, and partially segmented—*i.e.*, the four or five segments are indicated by shallow grooves commencing at the outer margin, as in the pleuræ of the thorax, and extending inwards towards the axis but a short distance, and terminating without reaching the latter, giving to the margin of the tail a more or less feebly crenulated appearance; the first of these grooves is the best marked.

Obs.—The occurrence of *Ampyx rostratus*, Sars, in the Girvan series and the fact that this, like the form now under description, is a species of the section *Lonchodomus*, render it necessary that a minute comparison should be entered into between the two to show in how far they differ.

In the course of the description of *A. Macallumi*, just given, we have shown that the glabella, as far as the base of the spine, is contained *within* the equilateral triangle forming the general outline of the head. On the other hand, if reference is made to our description of *A. rostratus*, it will be at once seen that to all intents and purposes only half the glabella is so contained, and that to convert the head in this species into an equilateral triangle, lines would have to be drawn from the base of the spine to the genal angles. It may be thought that this merely results from the absence of the free cheeks; it is, however, not so; for in our fig. 14 (Pl. XII.), representing a view of *Ampyx rostratus*, the free cheeks are plainly visible, occupying only the lower half of the head and, of course, coinciding with the fixed cheeks—whereas in *A. Macallumi* (Pl. XII., figs. 9 and 10), we suspect the free cheeks would occupy the whole length of the side of the head. We imagine such differences as these will be quite sufficient to separate the two species, presuming others to be absent; to show that other

points can be indicated, however, we would only refer to the pleural grooves on the thorax, the characteristic segmentation of the tail in each, and the absence of tubercles or nodes on the tail-axis of *A. Macallumi*.

We have not yet obtained a specimen of the species exhibiting the genal spines *in situ*, but there are in the same bed at Balcletchie isolated examples of the frontal margins of a Trilobite, with genal spines attached (Pl. XIII., fig. 11) which may belong to it. The spines are prismatic, with prominent edges, a central groove on each face, and delicate striæ.

As regards the vexed question of identification, we are unable to satisfactorily place this form under any species of which a description is within our reach, and we have been at some trouble to make ourselves acquainted with the characters of as many forms of *Ampyx* as possible. It will not do for either of Sars's species; none of those so beautifully illustrated by Angelin will contain our form, so far as we can judge by the figures; it certainly is neither of the Bohemian forms described by M. Barrande,¹ and nearly the same points relied on for separating the heads of *A. rostratus* and *A. Macallumi* will also suffice to mark a division between the latter and *A. Brückneri*, Boll.²

The form of the glabella is sufficient to distinguish *A. Macallumi* from *A. nasutus*, Dalman,³ and the same may be said of *A. parvulus*, Forbes,⁴ *A. prænuntius*, Salter,⁵ and *A. tumidus*, Forbes.⁶ No distinct alliance exists with any of the species described by the late Mr Billings, with the exception of *A. normalis*,⁷ which appears to come nearer to our form than any other we are acquainted with. The glabella appears to bear furrows which are not present in *A. Macallumi*, and the tail has not those peculiarities noticed in the foregoing description of the latter. In *A. nasutus*, Dalman, the pygidium is smooth

¹ Syst. Sil. Bohême, i. t. 30.

² Palæontographica, i. t. 17, f. 8.

³ Vet. Acad. Handlingar, 1826, p. 253, t. 5, f. 3.

⁴ Mem. Geol. Survey, ii. pt. 1, p. 10.

⁵ Ibid., iii. t. 8, f. 5.

⁶ Ibid., iii. t. 23, f. 6.

⁷ Pal. Foss. Canada, i. p. 295.

and the segments of the thorax are represented by pits or punctæ on the surface of the latter. In *A. Macallumi*, on the contrary, the side-lobes are segmented partially, and the axis regularly so.

We have much pleasure in adopting the MS. name applied to specimens now in the Museum of Practical Geology, by the late Mr Salter, who evidently regarded it as a new form.

Loc. and Horizon.—Balcletchie, in a fine-grained green mudstone (Gray Collection); Penwhapple Glen (*Mus. Pract. Geol.*),¹ and as *Ampyx nasutus*, Dalman (*ibid.*)

Ampyx (?) Macconochiei, Etheridge jun., and Nicholson (*sp. nov.*)

(Pl. XIV., fig. 1.)

Spec. char.—General form almost round, with the rotundity interrupted only by the produced glabella. The glabella and lateral lobes of the head-shield convex; the former apparently pyriform, enlarged forwards, and without any anterior spine; surface of the glabella and side-lobes (fixed cheeks) minutely punctate, the punctæ being arranged in concentric and slightly inosculating lines.

Thorax of five rings; axis very narrow as compared with the whole width of the thorax, convex; pleuræ horizontal, visibly grooved, much wider than the thoracic axis.

Pygidium small, widely semicircular; axis of apparently four or five rings, gradually tapering, convex; side-lobes of apparently four radiating subdivisions on each side, strong, and well marked; limb broad for size of the body, a little bevelled, and concentrically lineate. Surface of the thorax and pygidium punctate, but the punctæ coarser and stronger than on the head-shield.

Obs.—We were for some time inclined to regard this peculiar little Trilobite as a *Trinnucleus*, but acting on the advice of our friend, Dr H. Woodward, we have provisionally referred it to *Ampyx*. The head-shield in several species of both these genera is punctate, but we are not acquainted with any in which

¹ Cat. Foss. M.P.G., 1865, p. 18.

the whole surface is so, as in the present instance; and, again, as regards a reference to *Trinnucleus*, we have not seen a trace of the punctate-fringe in any of the specimens before us. The chance of its being an immature form has also been considered by us, but without any satisfactory result.

We are unacquainted with any species to which this could be referred, and therefore take the opportunity of associating with it the name of Mr A. Macconochie, of H.M. Geological Survey, who has collected largely in the Girvan district.

Loc. and Horizon.—Balcletchie, in a greenish fine-grained mudstone. (Gray Collection.)

Ampyx Hornei, Etheridge jun., and Nicholson (*sp. nov.*)

(Pl. XIII., figs. 4-8.)

Spec. char.—Cephalic shield semicircular, the margin truncated and curved upwards anterior to the glabella. Glabella, taken as a whole, somewhat pyriform, with a prominent, gibbous, mammillary, blunt, and upwardly-projecting frontal lobe, extending to the anterior margin, but not projecting beyond it, and terminating in an apical tubercle; the basal contracted portion of the glabella bears, on each side, two elongated, obliquely and outwardly directed furrows, and faint indications of a third near the neck, the glabella being contracted backwards between the grooves in the form of a rounded blunt ridge. Neck-furrow well marked, rather broad, extending the whole transverse length of the shield; neck-segment narrow, projecting backwards in the middle line. Fixed cheeks broad and wing-like, flat, or a little convex, traversed diagonally from about the middle of the frontal lobe of the glabella, by a series of radiating lines or ridges, of which two are usually more strongly marked than the others, and are sometimes the only ones visible; these ridges start from a common base, represented by a small irregularly-rounded elevation, having much the appearance of an eye-spot. Facial suture obliquely elongated and undulated. Free cheeks not preserved, but probably elongated and linear, and terminating posteriorly in genal

spines. Thorax of six segments; axis convex, with well-developed marginal tubercles. Pleuræ horizontal, broad, grooved. Pygidium transversely triangular, large; axis rapidly attenuated, apparently segmented for its entire length; side-lobes segmented entirely across, the first segment prominent and separated by a deep groove; limb broad, with sharply-defined and very fine concentric ridges, bifurcating, or perhaps inosculating and having the intermediate valleys pitted.

Obs.—We have associated with this species, a moderately abundant one at Girvan, the name of Mr J. Horne, F.G.S. (of H.M. Geological Survey of Scotland), who has worked assiduously at the geology of the southern uplands of Scotland. Our species is allied to *Ampyx mammillatus*, Sars, but we have found it necessary to separate it for the following reasons :—

In 1835 Sars described, under the name of *Ampyx mammillatus*, portions of three cephalic shields and a tail of a Trilobite.¹

In 1843, Colonel Portlock,² in referring to the figures of Sars, expressed a doubt whether they could all be the same species. He said, “The glabella is represented in one figure blunt in front, less so in another, and elongated in a third: and it is very doubtful whether these are really the same species.” The same view appears to have been independently arrived at by Boeck,³ as stated by him in 1838, but he does not there suggest any alteration. Boeck’s view, however, appears to have been adopted by Angelin,⁴ who restricted the name *Ampyx mammillatus* (Sars) to that figure by Sars with the truncate anterior margin (*loc. cit.*, t. 8, f. 4^c); and, as he tells us in the context of his work, referred Sars’s other three figures (*loc. cit.*, t. 8, f. 4^{a, b}, and ^d) to *Ampyx costatus* (Boeck) apparently a name used by Boeck in the Christiania Museum. In addition to this, Angelin gives figures of both these species. (a.) Now, in the first place, in reviewing the restriction made by Angelin

¹ Oken’s *Isis*, p. 335, t. 8, f. 4, *a-d*.

² *Geol. Report*, Londonderry, p. 261.

³ *Gæa Norvegica*, heft. 1, p. 144.

⁴ *Pal. Scand.*, p. 80.

and Boeck, one is struck with the great dissimilarity between Sars's figures (figs. 4^a and 4^b), which these observers call *A. costatus* (Boeck). One (fig. 4^a) has a perfectly rounded outline to the anterior portion of the glabella, with the central apical tubercle; the other (fig. 4^b) has a very much anteriorly-produced glabella, which is cut at its sides by the anterior margin of the head, whereas in the former figure the anterior margin of the head completely encircles the glabella. Can these be identical or not? If not, to which should the name *A. costatus* (Boeck) apply? (b.) On comparing Angelin's figures of *Ampyx costatus* (*loc. cit.*, t. 40, f. 1) we observe that in this case they so far resemble one of those by Sars (*loc. cit.*, t. 8, f. 4^b) as to have a produced glabella, irrespective of the spine, and so differ from the first of the figures given by the same author (fig. 4^a). On the other hand, Angelin's same figures represent the glabella as cut by the anterior margin of the head much nearer the base of the spine than does the corresponding delineation by Sars (t. 8, fig. 4^b). Lastly, compare the nature of the glabella-grooves in Angelin's and Sars's figures of *Ampyx costatus*. In those of the former they are represented, more or less, as a series of linear depressions following nearly the line of the axial grooves; but in the figures of Sars, whichever one takes, they appear to be nearly two parallel and oblique grooves, giving rise to the formation of small lobes.

After mature consideration of the subject, it appears to us impossible to regard Sars's figs., 4^a and 4^b, the one with the blunt glabella terminating in a tubercle, the other with a produced glabella prolonged into a spine, as the same—at any rate in the light in which species are now regarded. Had we restricted *Ampyx mammillatus*, Sars, we should have felt very much more inclined to have united the figs. 4^a and 4^c in one species, rather than figs. 4^a and 4^b, as done by Angelin. Even figs. 4^a and 4^c do not quite coincide with one another, but they certainly agree very much better than the others. That Boeck and Angelin were correct in splitting up *A. mammillatus*, Sars, there can be no doubt; it is a question, however, if the

correct separation has been made. After all, it is just possible it may be a question of sex, but as it is almost next to impossible to indicate what were or were not sexual characters in certain extinct groups of fossils, the only other course open to the palæontologist is to consider such forms from a specific point of view.

We are extremely indebted and obliged to Professor Kjerulf, Director of the Christiania University Museum, for the loan of authenticated specimens of *A. mammillatus*, Sars, and *A. costatus*, Boeck, kindly forwarded to us by Conservator W. C. Brögger, also of the above institution, by means of which we have been able to work out the above subject, and compare with them our Girvan forms.

Passing now to the latter (Pl. XIII., f. 4-8) we would point out that they approach nearest to *A. mammillatus*, Sars, as restricted,¹ in the presence of a truncated anterior margin to the cephalic shield, blunt glabella terminating in a tubercle, and not a spine, and strong neck-segment. On the other hand, if the glabella-furrows in Sars's figure are correctly drawn, a point upon which we have some doubt, then there is here a marked difference between the Swedish and Scotch forms. In addition to this, there is in the latter a backward prolongation of the neck-segment which does not appear to exist to any extent in the restricted *A. mammillatus*, although it is more marked in that figure of *A. costatus*² with the non-produced glabella. Setting aside these discrepancies, however, there is a much more important one to be mentioned. In our specific diagnosis we described a series of ridges radiating from a defined point across the cheeks of *A. Hornei*. Now, neither in the figures of Sars or Angelin, nor yet on the actual specimens forwarded to us from Sweden, is there the slightest trace of such ridges. It affords us much pleasure to state that our friend Dr H. Woodward, F.R.S., is quite at one with us in regarding this as a sufficiently important structural difference between the Scotch and Swedish fossils to warrant a specific separation.

¹ Isis., t. 835, t. 8, f. 4^c.

² Loc. cit., f. 4^a.

One other point in connection with this requires to be noticed. Colonel Portlock described an Irish species as *Ampyx Austinii*,¹ which has hitherto been regarded as a synonym of *A. mammillatus*, Sars (restricted). As in the case of Sars's species, there is here no mention made, or trace in the figure, of radiating cheek-ridges; and we can therefore only conclude that *A. Austinii* did not possess such, and is in consequence quite distinct from our *A. Hornei*.

In describing the other species of *Ampyx* from Girvan, we placed them under and made use of the subdivisions of the genus proposed by Angelin. We cannot at the present moment recall any other species of this genus possessing similar cheek-ridges, and we consider this character of sufficient importance in itself to indicate *A. Hornei* as worthy of separation from the typical *Ampyx* in an equal degree with the other species referred to.

Locality and Horizon.—Balclatchie, in a fine-grained greenish mudstone (Gray Collection); Penwhapple Glen, in a similar matrix (*Coll. Mus. Pract. Geology*).

Genus TRINUCLEUS, Lhwyd, 1699.

(Lith. Brit. Ichnographia, p. 97.)

Obs.—In 1849,² and again in 1851,³ Professor M'Coy proposed the subdivision of the genus *Trinucleus* into two sections or genera—*Trinucleus* proper and *Tretaspis* M'Coy,—depending on the presence in the latter of five thoracic segments, two furrows on each side of the base of the glabella, a diagonal eye-line crossing the cheeks, occupying the position of the facial suture more or less, and usually a small apical or culminating tubercle ocular (?) in character.

This subdivision was adopted by the late Mr Salter in 1853,⁴ who thus defines *Tretaspis*, M'Coy: "Ocular tubercle dis-

¹ Geol. Report, p. 261, t. 1, B. f. 1 and 2.

² Annals Nat. Hist., 1849, iv. p. 410.

³ Brit. Pal. Foss., fas. 1. p. 146.

⁴ Mem. Geol. Survey, Dec. vii., No. 7, p. 7.

inct; eye-line cutting the posterior margin, but the head not separable at the sutures; glabella lobed."

It will be observed that the character of the five-segmented thorax of M'Coy is here abandoned, consequent upon the discovery of a metamorphosis in *Trinucleus* by M. Barrande.

Against this subdivision M. Barrande has strongly protested,¹ and on the following grounds. He observes that, 1st, the "eye-line" is not distinct and sharp, as is usually the case with a facial suture; 2d, it is a simple nervure, and as such is visible in many other Trilobites, as, for instance, *Conocephalites Sulzeri*, without any trace of facial suture, whilst in another species, *C. striatus*, it coexists with that structure; 3d, in *T. seticornis* and its allies the cheeks are constantly found attached to the head; 4th, *T. Bucklandi*, Barr., placed by M'Coy as one of the types of his *Tretaspis*, never possesses any real suture, or an eye-line similar to that of *T. seticornis*, whether British or Swedish forms are selected for illustration. We would observe that this view was expressed by M. Barrande after an inspection of the specimens in the Woodwardian Museum used by M'Coy.

In another place,² M. Barrande again returns to this subject, and further shows that,—1st, the 5-segmented thorax is of no moment, consequent on the metamorphosis which is undergone by *Trinucleus*; 2d, the two grooves on each side of the base of the glabella are, from their presence in *T. Bucklandi*, as much a character of specimens with a 6- as a 5-segmented thorax; 3d, the "ocular" tubercle occurs as frequently in *T. seticornis*, His., *sp.*, or *T. Bucklandi*, with six segments to the thorax, as it does in M'Coy's forms with only five.

In the views thus elaborated we entirely concur with M. Barrande, and we are now able to demonstrate the accuracy of his conclusions. We have examined more than fifty specimens of a species, hereafter described in detail as referable to *T. seticornis*, var., and all of which are British. Some of these have five segments to the thorax, two well-

¹ Syst. Sil. Bohême, i. p. 617.

² Ibid., p. 620.

marked grooves at the base of the glabella on each side, and no cheek-tubercles; others, again, possess a 6-segmented thorax in combination with the characters just mentioned; again, there are other conditions in which may be seen a 6-segmented thorax, two glabella-furrows on each side, and apical or culminating tubercles present on the cheeks, while the latter are crossed by the so-called eye-line; and lastly, we have before us a beautifully-preserved cephalic shield from Pomeroy in Ireland, in the Museum of Practical Geology, possessing all the essential characters of *T. seticornis*, and of M'Coy's *Tretaspis*, with a tubercle on each cheek, and with the basal constrictions to the glabella, but without the slightest vestige of an "eye-line" crossing the cheeks. We think this conclusively proves the correctness of M. Barrande's reasoning.

Notwithstanding the fact that *Tretaspis*, either as proposed by M'Coy, or as defined by Salter, will not stand, it becomes a question with us whether the name may not advantageously be retained, as a section, for those *Trinuclei* with a lobed glabella, in contradistinction to those in which it is entire, or more or less entire at any rate.

Trinucleus seticornis, Hisinger, *sp.*, var. *Bucklandi*, *Barrande*.

(Pl. XIII., figs. 13-20.)

(*Asaphus seticornis* et *A. cyllarus*, His., Leth. Suecica., 2d Suppl., p. 3, t. 37, f. 23; *Trinucleus*, Lovén, Öfv. K. Vet. Akad. Förhandl., 1845, No. 4, p. 107, t. 2, f. 1, a-g.)

Trinucleus seticornis, Portlock, Geol. Report 1843, p. 263, t. 1, B. f. 8, a-c.

„ *Bucklandi*, Barrande, Note Prélim., 1846, p. 31.

„ *seticornis*, M'Coy, Synop. Sil. Foss., Ireland (1846), 1862, p. 56.

„ *Bucklandi*, Corda, Prod. Mon. Böhm. Trilob., 1847, p. 39.

Tretaspis seticornis, M'Coy, Brit. Pal. Foss., 1851, fas. 1, p. 47.

Trinucleus Bucklandi, Barrande, Syst. Sil. Bohême, 1852, i. p. 621, t. 29, f. 10-17.

„ (*Tretaspis*) *seticornis*, Salter, Mem. Geol. Survey, Dec. vii., 1853, No. 7, p. 7.

„ *seticornis*, Salter, in Murchison's Siluria, 1867, 4th ed., p. 69, Foss. 14, f. 1 and 1.

Spec. char.—General outline oval, with the head much

elevated above the level of the body; the thorax and pygidium are about equal in length, but the cephalic shield is much longer than either, semicircular in form, and most convex exactly in the median line. Glabella pyriform, with the anterior portion much inflated, spherical, and very convex, rising high above the cheeks, and gradually attenuated posteriorly to a more or less depressed, elongated, narrow neck, and having its apex, or culminating point, occupied by a persistent tubercle; the neck bears on each side two deep, laterally-elongated pits or fossæ, of which the anterior pair are the larger, and take the place of regular glabella-grooves; axial furrows surrounding the glabella, broad and well-marked in their posterior parts, gradually decreasing in depth and width towards the anterior margin, terminating on each side of the glabella, immediately behind the punctate fringe, in a circular pit or foramen, which is deep in young, but becomes almost imperceptible in old, individuals; half-way between these pits and the anterior pair of glabella-furrows on each side is situated another similar but shallower and larger depression, which, instead of interrupting the course of the axial furrows, is excavated in the lateral margins of the glabella itself; they are less perceptible in the young than in the old state. Cheeks subtriangular, strongly convex, situated at a much lower level than the glabella, graduating outwards towards their exterior margins, but abrupt next the body; each cheek provided with an apical or culminating tubercle, which may be very prominent or depressed, but is always stronger than that on the glabella, and is always present in the young state, although absent in the old condition; there is usually an "eye-line" extending across the cheeks from the punctum on the side of the glabella, passing through the cheek-tubercles and terminating at each posterior lateral angle, but it is not always present. The neck-furrow is broad, although not deep, and constricts the base of the glabella, giving rise to the appearance of a third pair of furrows. Neck-segment narrow. Surface of the glabella reticulate. The prominent and well-

marked limb in front of the glabella is inclined at an angle of about 85° ; but more posteriorly, at the sides of the cheeks, and where continued to the thorax, it is almost vertical. In front of the cheeks and glabella the limb is at first convex, it then becomes concave, and gradually turns upwards and outwards, being bordered by an inwardly bevelled and striated margin; in the vertical portion at the sides of the head the concavity is lost, and the prominent front margin gradually extending backwards is produced into long, tapering, striated, genal spines, which reach some distance beyond the posterior margin of the pygidium. In the young condition the convex part of the limb in front of the head is occupied by three concentric rows of circular, funnel-shaped holes or punctures, the concavity and the upwardly-turned margin exhibiting a row of transversely-elongated depressions, each of which really contains two of the previously-mentioned holes, placed one in front of the other. The adult condition only differs from this in the increased number of the concentric rows of holes on the convex portion, the result being that the limb, anterior to the head, has the circular depressions arranged in both a concentric and radiating manner. In both young and old, increase in the number of the rows takes place by interpolation, so that at whatever point the punctæ are counted vertically, the number in each row increases more and more as the posterior margin is approached. In young individuals a row taken immediately below the posterior angles of the cheeks would number from five to six holes, a row at the posterior termination of the fringe numbering seven to nine along the incurved margin of the limb; whilst in adults the posterior margin will have against it from ten to fourteen holes; and in the vertical portion of the fringe the perforations lose both their radiate and concentric arrangement in a great measure. When the integument is removed from the limb, the concavity is seen to be occupied by a narrow zone, or broad groove, extending from one end to the other, concentrically striated, and devoid of any trace of the perforations which

appear when the integument is preserved; at the same time the upturned edge of the front margin is occupied by a single line of punctæ, which increases to two lines towards the posterior angles.

The thorax consists of six segments; the axis is convex, but of less width than the lateral lobes or pleuræ; it tapers gradually, and each segment is transversely striated; the distal portions of the segments are separated from one another, from front to back, by deep depressions on each side, especially in casts; axial grooves shallow. Pleuræ horizontal, flat; pleural grooves extending nearly the whole breadth of the pleuræ; the backwardly-directed facet-portion of each is longitudinally striated.

Pygidium semicircular; axis gradually tapering to an acute apex in the old condition, broader in the young, and composed of six, seven, or nine rings, which are similar in character to those of the thorax; lateral lobes indistinctly marked, with a varying number of indistinct subdivisions. Surface of pygidium apparently unornamented.

Possessed the power of rolling up.

Obs.—After describing the beautiful Trilobite named by him *Trinucleus Bucklandi*, M. Barrande, on the one hand, enters into a minute comparison between it and typical specimens of *T. seticornis*, Hisinger, from Sweden; and, on the other, compares examples of the latter species from Ireland with *T. Bucklandi*, with the view of showing the close identity existing between the three forms.

M. Barrande finds that adult specimens of *T. seticornis*, His., from Sweden differ from his Bohemian species: 1st, by the form of the punctate limb, which does not extend in the former beyond the head, and is not applied to the sides of the thorax; 2d, in the axis of the pygidium, which throughout its course is identical in size with that of the thorax, and has a truncated posterior end, in place of a gradually-narrowed axis terminating in a more or less acute point, as in *T. Bucklandi*; 3d, by the persistence of the tubercles on the cheeks. The author

then proceeds to observe that these differences gradually disappear if we look upon the form of *T. seticornis*, His., figured by Lovén as representing only the young or medium age. In other words, says M. Barrande, young Bohemian specimens of *T. Bucklandi* agree in every particular with Swedish examples of *T. seticornis*; and the species only differ, as above pointed out, when adult forms of the Bohemian species are examined. From these facts M. Barrande is disposed to regard his *T. Bucklandi* as identical with *T. seticornis*; but the question is left an open one for other palæontologists, particularly those of Sweden, to decide.

The remarks on the Irish examples of *T. seticornis* by the learned Bohemian naturalist, are equally to the point. He observes that, so far as such are known to him, they appear identical with the young condition of his *T. Bucklandi*, except in the eye-line described by Professor M'Coy on the cheeks of the former which is never seen on those of the latter. Further, M. Barrande states that the late Mr Salter discovered the characteristic reticulation visible on the glabella of young *T. Bucklandi* on British specimens referred to *T. seticornis*, His. He had, moreover, personally seen similar ornamentation on examples from Tyrone which agreed in size with the middle age of *T. Bucklandi*, likewise possessing the limb applied to the sides of the thorax and nearly vertical in position. These and other points mentioned evidently lead M. Barrande to the provisional conclusion that little difference will ultimately be found to exist between *T. seticornis*, His., from Sweden, the British Trilobites referred to this species, and his *T. Bucklandi*.

It affords us much pleasure to be able to clear up, to a certain extent at least, the relation existing between the foregoing forms. With this view we think we cannot do better than in the first place show how our British examples of *T. seticornis* agree with *T. Bucklandi*, Barr., merely stating that the specific description just given is drawn up from specimens derived from Irish, Welsh, and Scotch rocks; the examples of the former

being in the Museum of Practical Geology, of the latter in the "Gray Collection." After all, perhaps, a special verbal comparison is almost superfluous when a perusal of the respective specific descriptions by M. Barrande and ourselves, and a glance at the figures in the plates of both, should be sufficient to show that we undoubtedly possess *Trinucleus Bucklandi* in our British rocks. However, it may be at once stated that the form of the body (Pl. XIII., figs. 13 and 15) is in both cases the same,¹ the arrangement and backward extension of the punctate fringe are similar, as also is its stopping in the young state a little behind the cheek-angles (Pl. XIII., figs. 15 and 15^a), but increasing and becoming applied against the thoracic segments with age (Pl. XIII., fig. 13). The glabella is as spherical in our specimens, or perhaps a little more so, and invariably has the culminating tubercle both in the young and old condition. Further, we figure (Pl. XIII., fig. 17) its reticulate surface, a character already noticed in British specimens by Mr Salter and M. Barrande himself. As in Bohemian examples, so in ours, the culminating or apical tubercles on the cheeks are always present in the young, but never in the adult state. The young of the British examples usually possess the "eyeline," a phenomenon which Barrande says is never to be seen in Bohemian specimens, either old or young. It certainly does not occur in our aged examples and not always in the young condition. We give an exceedingly beautiful illustration of this (Pl. XIII., figs. 14 and 20); and we might, if necessary, continue the comparison with an examination of the glabella-furrows (even to the presence of the deep pit at the anterior end of the axial grooves of the glabella), the genal spines, and the characters of the thorax or pygidium, the result in all cases tending to show the identity of *T. Bucklandi*, Barr., with both the old and young stages of those Trilobites usually referred by British palæontologists to *T. seticornis*, Hisinger. In the collection furnished by M. Barrande to the British Museum

¹ Compare Barrande's figures, Syst. Sil. Boh. Atlas, t. i. pl. 29.

are several examples of the young and middle age of *T. Bucklandi*, with which we have compared the British specimens, and we are quite satisfied as to their identity.

Passing on to a consideration of the resemblance, or otherwise, existing between the British and Swedish forms, we would point out that, so far as we know, the fullest and most detailed description of *T. seticornis*, His., *sp.*, with which we are acquainted, is that by Lovén,¹ who, in his synonymy, admits the figures of Irish specimens of that species by Portlock; specimens presumed to be the originals of those we have been fortunate enough to study. A fact, moreover, which must not be overlooked, is that Portlock figured² the reticulate structure of the head in British specimens before it was noticed either by Salter or Barrande.

We hoped to have been able to compare authenticated Swedish examples with our British fossils; but we have been unable to meet with these, and must wholly rely, therefore, on figures. We see by those of Lovén and Angelin that the form of the head and body closely corresponds in both; the spherical glabella and convex cheeks are identical, and there are similar furrows. In the side view of the head given by Angelin,³ the glabella appears too long for either *T. Bucklandi* or our specimens—the spines are decidedly much longer. Both these authors represent the cheek-tubercles present in their figures, which are of the natural size, and larger than the largest of our full-grown examples. Again, on the other hand, Angelin's side view of the head shows a similar bent down fringe, turned up in front, vertical behind; whilst in an enlargement⁴ by the same author, we observe the striated space round the fringe devoid of perforations, where the integument is removed, which quite corresponds with the figure we give (Pl. XIII., fig. 19). In other words, the Swedish *T. seticornis* appears to differ from the British fossils of the same name in exactly the same features as it does from the Bohemian *T. Bucklandi*, Barr.—viz., in the

¹ Öfv. Vet. Akad., 1845, No. 4, t. 2, f. 1, *a-g*.

³ Pal. Scand., t. 40, fig. 19^a.

² Geol. Report, t. 1, B. f. 8^c.

⁴ Ibid., fig. 19^c.

restriction of the punctate fringe to the head, and its non-application backwards to the sides of the thorax; in the non-attenuation of the axis of the pygidium; and by the presence of the cheek-tubercles in what appears to be an adult form. If, therefore, these points are to be considered of specific importance, then our British *T. seticornis* has more affinity with *T. Bucklandi*, Barr., than with the true *T. seticornis*, His., and should be united with the former. But, on the other hand, if we admit with M. Barrande that the differences thus apparent are only those of age, we then have the adult Swedish form of *T. seticornis* equal to the young and middle age of the Bohemian and British forms. This we at present believe to be the safest and best course, especially as, 1st, Lovén admits Portlock's figures into his synonymy of *T. seticornis*, His., *sp.*; 2d, Salter, who had opportunities of examining Swedish examples, considers the British fossils to be identical with these; 3d, the same author places *T. Bucklandi* as a synonym of *T. seticornis*, His., *sp.* We entertain, therefore, little doubt of the identity, speaking in a broad sense, of all these forms, notwithstanding the trivial differences which appear to separate them.

Under these circumstances, we propose to consider the Bohemian and British fossils as a variety of the true species of Hisinger, as *T. seticornis*, His., *sp.*, var. *Bucklandi*.

We find that the structure of the punctate fringe in our specimens is of a very interesting character. In an exceedingly well preserved specimen, we notice that the funnel-shaped perforation, or punctum, is closed by a diaphragm, which, in its turn, is pierced by a small pore (Pl. XIII., fig. 15^b). This is to a certain extent figured by Lovén,¹ but our specimens show it in a marked degree.

Loc. and Horizon.—Drummuck, in a fine-grained greenish mud or sandstone (*Coll. Mus. Pract. Geol.*; Gray Collection, &c., &c.)

¹ Öfv. Vet. Akad. Förhandl., 1845, t. 2.

Trinucleus concentricus (Eaton), Salter.*T. concentricus* (Eaton), Salter.

,, Salter, Mon. Brit. Trilobites, pt. 4, 1867, p. 211.

Obs.—In giving the locality of his *Illænus Macallumi*, the late Mr Salter casually mentions that *Trinucleus concentricus* occurs “in the same deposit of hard yellow sandstone and grit” with *Illænus Thomsoni* and *Atrypa hemisphærica* at Mulloch Hill. For our own part, we have not met with this species at the locality mentioned; but fragments of a punctate fringe occur at Shalloch Mill, not at all unlike that of the species in question.

Loc.—Mulloch, in sandstone. (Salter).

Trinucleus, sp. ind.

(Pl. XIV., figs. 2-4.)

Obs.—Another form of *Trinucleus* is found at Shalloch Mill, chiefly as fragments of the punctate limb; but we have an entire tail, and portions of a head which may belong to the same species. The fringe (Pl. XIV., fig. 3) appears to have been a horizontal one, little or not at all bent down, and the cheeks highly scrobiculate; the posterior angles terminated in small spines.

The pygidium (Pl. XIV., fig. 4) associated with these remains is of a widely triangular form, sharp at the lateral angles and apex; the axis is multisegmentate, of ten or more rings, and the lateral lobes are crossed by a much less number of wide flat segments; the limb was longitudinally striated.

We are unable to determine with any certainty to what species these remains are referable. The punctate limb (Pl. XIV., fig. 3) has somewhat the aspect of that of *T. concentricus*, Eaton; but the pygidium, although similar in appearance, is too decidedly triangular.

Loc. and Horizon.—Shalloch Mill, in an argillaceous shale containing a good deal of lime. (Gray Collection.)

Genus SALTERIA, Wyv. Thomson, 1864.

(Mem. Geol. Survey, Dec. xi., No. 6, 1864, p. 1.)

Salteria primæva, Wyv. Thomson.

(Pl. XIV., fig. 5.)

S. primæva, Wyv. Thomson, *loc. cit.*, t. 6.

„ Bigsby, Thes. Sil., 1868, p. 67.

„ R. Etheridge, jun., Proc. R. Phys. Soc. Edinb., 1878, iv. p. 170.

Obs.—We have little to add to the description of this Trilobite given by Sir Wyville Thomson; but we are able, through the zealous collecting of Mrs Gray, to give a figure (Pl. XIV., fig. 5) of a more perfectly preserved specimen now in the Hunterian Museum.

In addition to the description above referred to, we may state that the base of the glabella, where it cuts off the neck-segment, is very delicately striated like the former, on which the striæ inosculate.

The thorax consists of at least six somites; the axis is slightly convex, and the segments striated parallel to the longer axis. The pleuræ are horizontal and obliquely striated, although one or two of the most anterior appear to be ornamented like the rings of the axis.

The central lobe of the tail has at least eight rings. We are not acquainted with either the free cheek or eye; in fact, we doubt if the latter exists in this genus.

Loc. and Horizon.—Balcletchie, in a fine-grained greenish mudstone (*Coll. Mus. Pract. Geol.*; Gray Collection; *Hunterian Museum*; "Graptolite and Orthoceratite flags," Penwhapple Glen, Wyv. Thomson).

Genus AGNOSTUS, Brongniart, 1822.

(Hist. Nat. Crust. Foss., 1822, pp. 8 and 38).

Agnostus agnostiformis, M'Coy.

(Pl. XIV. fig. 6.)

Trinodus agnostiformis, M'Coy, Sil. Foss., Ireland, 1846, p. 57, t. 4, f. 3.*Agnostus convexus*, Salter, Mem. Geol. Survey, 1848, ii., pt. 1, p. 351, t. 8, f. 12 and 13 (*non*. f. 11).*Trinodus agnostiformis*, M'Coy, Brit. Pal. Foss., 1851, fas. 1, p. 141, t. 1, E., f. 10.,, *tardus*, M'Coy, *loc. cit.*, p. 142, t. 1, E., f. 9 (*non*. Barrande).*Agnostus trinodus*, Morris, Cat. Brit. Foss., 1854, 2d ed., p. 99.

,, ,, Salter, Mem. Geol. Survey, Dec. xi., pt. 1, p. 8, t. 1, f. 8-10.

,, ,, Salter, Mem. Geol. Survey, 1866, iii., p. 297, t. 19, f. 8.

,, ,, Salter, Murchison's Siluria, 1867, 4th ed., p. 204, Foss., 46, 6.

,, ,, Bigsby, Thes. Sil., 1868, p. 36.

,, ,, Salter, Cat. Camb. Sil. Foss., Woodwardian Mus., Cambg., 1873, p. 48.

,, ,, Woodward, Cat. Brit. Foss., Crustacea, 1877, p. 22.

,, ,, R. Etheridge, jun., Proc. R. Phys. Soc. Edinb., 1878, iv. p. 173.

Obs.—We are unable to supplement Mr Salter's description of this species beyond stating that we have observed traces of the thoracic somites. In some specimens the mucronate posterior angles of the head are visible, and the short spines on the limb of the tail.

This species was originally described by Professor M'Coy as *Trinodus agnostiformis*, but from the non-adoption by palæontologists of the term *Trinodus* in a generic sense, it was transferred to *Agnostus* by Salter. We presume Mr Salter changed the specific name given by M'Coy from, as he considered, a too close resemblance to the generic name, and as having little or no meaning from a precise specific point of view. For our part, we maintain that, a name once given, without it can be shown to be preoccupied, should be adopted, although it may at first sight appear peculiar from its resemblance to the generic term. Those working at the subject would be quite as well

able to understand the meaning of *Agnostus agnostiformis* as of *Agnostus trinodus*, especially if the term *Trinodus* be applied in a sectional sense, as is done through his 'Monograph' by Mr Salter. The name would then be written *Ag. (Trinodus) agnostiformis*; and viewing it in this way, we fail to see why M'Coy's name should be relegated to the synonymic list.

If *Dendrophyllia dendrophylloides*, Lonsdale, a Bracklesham Coral, be admitted to be rightly designated—and it is so by Messrs Milne-Edwards and Haime¹—we fail to see why the name here in question should not be preserved also; and we think that the practice of changing a specific or generic name for the sake of euphony, or because of some slight defect in its composition, is one which should not be followed except under special and aggravated circumstances.

Loc. and Horizon.—Balcletchie, in a fine-grained green mudstone (Gray Collection); Penwhapple Burn (*Mus. Pract. Geology*);² Piedmont Glen (*Mus. Pract. Geol.*)³

Addenda (TRILOBITES).

Phacops Brongniarti, Portlock.⁴

(Pl. XIV., figs. 7 and 8.)

Obs.—We give a supplementary figure of a very large decorated example of this species, which has, unluckily, been subjected to pressure and distortion to some slight extent. The characteristic sutures of the glabella are quite visible on one side of the head, and a part of the eye on the other. The pleuræ of the thorax in *P. Brongniarti* appear to be of a very well marked character, much bent down, with oval partially free distal terminations, and strong central grooves. We also figure another head in which the glabella-grooves are particularly well shown.

¹ Brit. Foss. Corals, p. 36.

³ Cat. Foss. M.P.G., 1865, pp. 4 and 7.

² Salter, Decade, xi., No. 1, p. 9.

⁴ See p. 99.

Locality.—Drummuck (*Coll. Geological Survey of Scotland*), collected by Mr A. Macconochie; Ardmillan (Gray Collection).

Cheirurus bimucronatus, Murchison.¹

(Pl. XIV., fig. 9.)

Obs.—In our First Fasciculus we mentioned the occurrence of this species on the authority of the late Mr Salter. Shortly after going to press our attention was called to the fine thoracic fragment represented as above.

The specimen is a well-marked internal cast, measuring as now preserved one inch eight lines long, by two inches four lines wide, the rings of the axis measuring on an average one inch wide by four lines long. From the axial groove to the broad side-groove is exactly half an inch; the side flaps or outer portions of the pleuræ at their broadest point are three lines wide from front to back; they bend more or less to the rear, and consist of a nodular end gradually decreasing outwards to a flat, elongated, blade-like expansion, terminating in an acute point. This external portion of each pleura is separated from the inner by a constriction, the series of constrictions forming a groove, parallel with the thoracic axial furrows. The inner portion of each pleura is the shortest, and most convex, and is divided into two elongated triangles by a narrow, deep, oblique groove, forming a diagonal, with an average length of five lines, which, in fact, unites the axial groove and the second groove parallel to it. The tubercles present on this part of the thorax are well described by Mr Salter.²

Locality.—Burn passing Bargany Pond, near New Dailly (*Coll. Geological Survey of Scotland*), collected by Mr A. Macconochie.

Cheirurus clavifrons, Dalman (?).³

(Pl. XIV., fig. 10.)

Obs.—In our First Fasciculus we gave a figure of a por-

¹ See p. 100.

² Monograph, p. 66.

³ See p. 101.

tion of the cephalic shield of a *Cheirurus* which we at one time thought might be distinct from the above.¹ The ornamentation consisted of a microscopically granular surface, with scattered pimples or small tubercles, and differed from the specimens referred to *C. clavifrons* in the possession of the latter character. We now take the opportunity of figuring, as previously promised, another specimen in which both styles of ornamentation are combined in the one example. At one point on the right-hand side of the figure a small fragment of the external crust may be observed, with a microscopically granular or frosted appearance, whilst over the general surface of the glabella may be seen a similar ornamentation, but also with the additional scattered small tubercles. This specimen clearly proves the identity of the subjects of our figs. 7 and 9, Pl. VII.

Locality.—Drummuck. (Gray Collection.)

***Cheirurus* (?) *sp. ind.* (a.)**

(Pl. XIV., fig. 11.)

Obs.—We have before us three specimens of a small pygidium which may be that of a species of this genus. So far as preserved, it appears to be oval in form, with a narrow convex axis of five segments, more or less horizontal side-lobes, each traversed by two, or perhaps three, ridges, which extend to the posterior margin of the tail, and probably, though we are not sure on this point, extended beyond in the form of free spines.

Loc.—Balcletchie. (Gray Collection.)

***Cheirurus* (?) *sp. ind.* (b.)**

(Pl. XIV., fig. 12.)

Obs.—We desire to call particular attention to the peculiar head represented on Pl. XIV., fig. 12. It appears to us to be a *Cheirurus* allied to the British species *C. gelasinosus*, Portlock. The frontal lobe and three lateral lobes on each side are

¹ Ibid., p. 104, t. 7, f. 9.

very well preserved, the former being strongly triangular, and the surface sparsely covered with tubercles; the central line of the glabella is somewhat carinate. Neck-groove well marked and broad; cheeks scrobiculate. A small pointed appendage in front of the truncated anterior end of the glabella. We are in doubt as to the position of the facial suture, and on this, in a great measure, depends the specific determination of the fossil. The only lines on the face of the cheek preserved are irregular cracks in addition to a diagonal ridge; none of these can represent the suture, so that we are at present compelled to look upon the curved lines joining the glabella on a line with the anterior pair of furrows as representing the facial suture. If this be so, it will at once separate our fossil from *C. gelasinus*, Portlock, or *C. bimucronatus*, Murchison, in both of which the facial sutures below the eye run on a level with the first pair of glabella-furrows, and their course is quite different to that here exemplified.

In some *Cheiruri* the fixed cheeks are very broad, and the facial sutures have a very forward position, quite on a level with the anterior pair of glabella-furrows, as in our specimen. Such are *C. Hawlei*, Barr.,¹ and *C. vinculum*, Barr.,² so that it is just possible the anterior curved line in our figure may represent the facial suture. We at first thought that the anterior projection in front of the glabella was a part of the labrum forced up from its natural position; but our friend Dr Woodward, who has been kind enough to closely study this specimen, believes it to be truly *in situ* and to the remains of a forward projection of the frontal lobe of the glabella, or perhaps an anterior spine, such as is sometimes seen in species of *Phacops*, for instance, *P. longicaudatus*. Another important point in this specimen is the diagonal ridge passing across the fixed cheek from the anterior furrow in the direction of the eye. We have only one specimen.

Loc.—Balcletchie. (Gray Collection.)

¹ Syst. Sil. Bohême, i. t. 42, f. 6.

² Ibid., Suppl. i. t. 12, f. 4.

Encrinurus punctatus, var. **calcareus**, Salter.

(Pl. X., f. 7.)

Obs.—In our First Fasciculus,¹ we alluded to the apparently rare occurrence of this variety of *Encrinurus punctatus* in the Girvan beds. Additional researches in that district have enabled Mrs Gray to add many interesting fossils to the list; one of them is the cast of the var. *calcareus* now figured (Pl. X., fig. 7), a tail, in which the extended mucro is broken off short.

Loc. and Horizon.—Penkill, in a fine-grained light-coloured mudstone. (Gray Collection.)

Cybele rugosa, Portlock.²

(Pl. XIV., fig. 13.)

Obs.—Dr J. G. O. Linnarsson has called our attention, since the publication of the First Fasciculus, to a paper by himself on Swedish Trilobites,³ of the existence of which we were previously not aware, and to the resemblance borne by our figures of *C. rugosa* to a form described by him as *C. Lovéni*.⁴ The resemblance is certainly very strong, but as we at present see no reason to doubt the accuracy of our reference of the Girvan specimens to *C. rugosa*, Portlock, we refrain from making any alteration in the name. Our command of a language so little used in this country as Swedish, is, unfortunately, limited; but so far as we can judge from Dr Linnarsson's figure, probably a very excellent one by the by, we should think it not improbable that *C. rugosa*, Portlock, and *Lovéni*, Linnars., may be identical, although the structure of the tail appears to be somewhat different in the two forms. The solution of this question can hardly resolve itself into a question of opinion—it must await the full description of *C. rugosa* from typical Irish examples, and the discovery at

¹ P. 108.² See *ante*, p. 112, t. 8, f. 5-7.³ "Om Vestergötlands Cambriska och Siluriska Aflagringar."—Kongl. Svenska Vetenskaps-Akad. Handlingar, B. 8, No. 2.⁴ *Loc. cit.*, t. 1, f. 14.

Girvan of specimens having still more complete tails than possessed by those before us. In one of our former illustrations of this species, the cephalic and thoracic spines were inadvertently omitted. We now repair this omission by giving a more accurate figure. (Pl. XIV., fig. 13.)

Acidaspis, sp. ind.

(Pl. XIV., fig. 14.)

Obs.—A figure of this little Trilobite is given more with the view of showing the hypostome in position than as a detailed figure of the form in question. The thorax was narrow and convex, the proximal portion of the pleuræ horizontal, the distal portion sharply bent down; general surface of the cast punctate. From a portion of another example on the same piece of matrix we learn that the truncated posterior margin of the tail was produced into six spines, the two outermost being the largest.

Loc. — Burn passing Bargany Pond, near New Dailly (*Coll. Geological Survey of Scotland*), collected by Mr A. Macconochie.

Proetus (?) or Acidaspis (?) sp. ind.

(Pl. XIV., fig. 15.)

The subject of fig. 15, Pl. XIV., is probably a small *Proetus* or *Acidaspis*, but we cannot at present do more than give a figure of the one specimen in our possession, which is quite decorticated.

Loc.—Burn passing Bargany Pond, near New Dailly (*Coll. Geological Survey of Scotland*), collected by Mr A. Macconochie.

Ampyx (?) sp. ind.

(Pl. XIV., fig. 16.)

Obs.—With the view of drawing attention to a peculiar head-shield, we have given the above figure, being that of an

only specimen. It has the appearance, to some extent, of both an *Ampyx* and a *Trinucleus*, but from the produced nature of the glabella, were it wholly preserved, with seemingly greater affinities to the former. The centre of the glabella and the outer halves of the fixed cheeks are granulated in a characteristic manner, so that we may hope in the future to receive further specimens. It may be provisionally regarded as an *Ampyx*.

Loc.—Balcletchie. (Gray Collection.)

Order PHYLLOPODA.

Genus SOLENOCARIS, J. Young, 1868.

(Proc. Nat. Hist. Soc. Glasgow, i. p. 171.)

Solenocaris solenoides, J. Young.

S. solenoides, J. Young, *loc. cit.*, pp. 171-173, t. 1, f. 7, *a* and *b*.

„ R. Etheridge, jun., Proc. R. Phys. Soc. Edin., 1878, iv. p. 167.

Obs.—Several fragments of this peculiar Crustacean are in the cabinet of Mrs Gray, by whom it was originally discovered. They do not, however, throw any additional light upon its structure. For a detailed account of this fossil we must refer the reader to Professor Young's description.

Solenocaris solenoides appears to have quite escaped the notice of all recent cataloguers of fossils, as we do not find it noticed by any recent writers. It must not be confounded with the later *Solenocaris*, Meek, which must be abandoned and another name proposed in its place.

Loc.—Balcletchie (*Hunterian Museum*; Gray Collection).

Genus PINNOCARIS, R. Etheridge, jun., 1878.

Pinnocaris, Etheridge, jun., Proc. R. Phys. Soc., 1878, iv. p. 167.

Gen. char.—Carapace bivalve, bent along the middle line; each half is pinna-form, much attenuated towards one ex-

tremity; dorsal margin almost straight, but rising at a little less than a third from the rounded end into a kind of false umbo; ventral (? lateral) margin elongately sigmoidal; the expanded end of the carapace is broadly but gradually rounded; attenuated end produced into a long, narrow rostrum or beak, truncated at its extremity; substance probably very thin; surface striated parallel to the curved margins.

Obs.—The above name was proposed for a very peculiar fossil in Mrs Gray's cabinet, from the resemblance each half of the specimens bore to the recent genus *Pinna*—so much so, indeed, that much doubt was felt whether to regard them as a species of Pelecypoda (Lamellibranchiata) near the genera *Pinna*, *Pteronites*, or *Aviculopinna*, or as the carapace of a Phyllopodous Crustacean, allied to *Ceratiocaris*, *Discinocaris*, and other like forms. In their present state the specimens appear as black, flattened, shining bodies, the produced and truncated end retaining more of the original convexity than the other portions. On analysing the various characters of these fossils, for, or against their crustacean nature, we find that in support of the latter view we have the absence of any definite separation into anterior and posterior ends, as in a bivalve shell; secondly, the nature of the projecting part of the dorsal margin, here called the false umbo, which in no way appears to partake of the characters of the umbo in the Pelecypoda; thirdly, the presence of the object, indicated at *a*, fig. 17 (Pl. XIV.), which, although without organic connection with the carapace near it, is, we believe, one of the telson-spines, similar to those of *Ceratiocaris*, and other genera; fourthly, the lines of growth, instead of graduating outwards from the projecting point of the dorsal margin, as the similar striæ do on the valve of a shell (bearing in mind that the umbo of a bivalve is its "initial point"), appear to us to be much more regularly concentric (or as we see them, semi-concentric) round a central point or apex, as would be the case if both valves were spread out, as occurs in the genera *Discinocaris* or *Peltocaris*. On the other hand, in support of the molluscan affinities of these fossils, we have the

general *pinna* or *pteronites*-like form, although the larger end is more obliquely rounded than is usually met with in these genera, and the entire absence of the characteristic punctate ornamentation seen on the carapace of many Crustacea, combined with the absence of all trace of the eye-spot. It appears to us that the balance of evidence is at present in favour of the Crustacean affinities of these fossils, and that they cannot be placed in any of the genera known to us, such as *Ceratiocaris*, M'Coy; *Hymenocaris* (*Saccocaris*), Salter; *Physocaris*, Salter; *Peltocaris*, Salter; *Dictyocaris*, Salter; *Dithyrocaris*, Scouler; *Myocaris*, Salter; *Discinocaris*, Woodward; *Solenocaris*, Young; *Lingulocaris*, Salter; *Caryocaris*, Salter; *Aptychopsis*, Barrande; *Solenocaris*, Meek (*non* Young); *Colpocaris*, Meek; *Archæocaris*, Meek; *Cryptocaris*, Barrande; and *Pterocaris*, Barr. As none of the specimens to which we have access have the valves spread out, it is impossible to say with certainty whether *Pinnocaris* had a dorsal furrow along the back, like *Peltocaris*, or was devoid of one, as in *Discinocaris*.

Since the above facts were first brought forward by one of us, we have not seen any reason to modify or alter them; on the contrary, the increased number of specimens at present in Mrs Gray's cabinet tend to make our conviction of the crustaceous nature of these fossils still stronger.

In Pl. XIV., fig. 17, a small spine-like body is seen in contiguity to one of the valves. It was at one time thought this might be a small *Theca*; but the general appearance, similarity in structure to the valves of *Pinnocaris*, and resemblance to the tail-spines of this order of Crustacea, lead us to the opinion that in all probability we have here one of the spines of the present species.

Many of the examples before us exhibit a groove, or rather impressed mark, as if the surface had somewhat given way, and proceeded obliquely downwards from the prominence on the dorsal line.

Pinnocaris Lapworthi, R. Etheridge, jun.

(Pl. XIV., figs. 17-20.)

P. Lapworthi, Etheridge, jun., Proc. R. Phys. Soc. Edin., 1878, iv. p. 169,
t. 2, f. 3-5.

Spec. char.—Identical with those of the genus; the greatest breadth is at a little less than the middle of the valve; concentric lines fine and close.

Obs.—The species was named in honour of Mr C. Lapworth, F.G.S., to whom we have been on several occasions indebted for the communication of specimens.

Loc. and Horizon.—Balcletchie, in a fine-grained, dark-greenish mudstone (Gray Collection; *Mus. Practical Geology; Mus. Science and Art*, &c.)

Genus PELTOCARIS, Salter, 1863.

(Quart. Jour. Geol. Soc., xix. p. 87.)

Obs.—It affords us much pleasure to be the means of communicating the following note by our friend Dr H. Woodward, F.R.S., on the subject of the genera *Peltocaris*, *Discinocaris*, and *Aptychopsis*:—

“Among the numerous forms of Phyllopod Crustaceans whose carapaces have been met with in rocks of palæozoic age in this country, three genera are specially remarkable from the fact that they have a nearly circular or disc-shaped shield, not a bivalved carapace, as is commonly the case with the members of this order.

“The first of these genera, named *Peltocaris*, was described and figured by the late Mr J. W. Salter, in 1863 (Quart. Jour. Geol. Soc., vol. xix. p. 88), and was designed to contain certain flat circular shields composed of three parts—namely, two principal lateral valves united along the mesial line by a straight suture, and one anterior or rostral valve separated from the

lateral valves by a rostral furrow or suture, which, in this genus, forms a parabolic curve.

“The second genus, named *Discinocaris*, was proposed in 1866 by H. Woodward (Quart. Jour. Geol. Soc., vol. xxii. p. 504) for certain circular, slightly conical shields composed of two parts only—namely, a small triangular-shaped anterior valve separated from the rest of the carapace (which consists of but one piece) by a straight rostral suture.

“The third genus, named *Aptychopsis*, was founded by M. Barrande in 1872 (Supplément au vol. i. Syst. Silur. Bohême, p. 455, Pl. 33) to contain flat sub-circular carapaces composed of three valves—namely, two lateral or principal valves united by a straight suture or hinge-line, and one anterior or rostral valve, forming an isosceles triangle the sides of which are equally straight.

“In 1871, a new Phyllopod shield labelled ‘*Aptychoides*, *gen. nov.*,’ was presented by Mr A. Michie of Hawick to the British Museum. This specimen was obtained from the Middle Silurian of Yad’s Lynn, near Hawick, and was named by H. Woodward, in August 1872, *Aptychopsis Wilsoni*. Two other species previously received from Mr C. Lapworth, from the same horizon and locality, were also named by H. Woodward at that time as *A. glabra* and *A. Lapworthi* (Brit. Assoc. Reports for August 1872, and Geol. Mag., 1872, vol. ix. p. 565).

“Mr Woodward was then quite unaware that the generic name *Aptychopsis* had already been published by M. Barrande for similar forms of shield found in the lowest division (e 1) of the Upper Silurian of Bohemia. Of course, the genus is *Aptychopsis* of Barrande, *not* of H. Woodward, as erroneously printed in Messrs Armstrong and Young’s ‘Catalogue of the Western Scottish Fossils,’ 1876, p. 7, and in Woodward’s ‘Catalogue of British Fossil Crustacea,’ 1877, p. 69.”

Peltocaris (?), *sp. ind.*

(Pl. XIV., fig. 21.)

Obs.—The specimens agree in size with Salter's *Peltocaris aptychoides*,¹ being eleven millimetres in longest diameter: the rostral suture was possibly more angular than in *Peltocaris*; but as the specimens are both distorted and separated down the dorsal suture, it is somewhat uncertain what was the exact form of the rostral valve.

Under these circumstances it would be unwise to speak decidedly on this point, as it is to be hoped that other and better specimens will be found from this locality. M. Barrande remarks that the only ornamentation these flat Phyllopod shields present is a series of concentric and radiating striæ, observable on their inner surface, and seen on the casts of the English specimens. There seems good reason to conclude, from an examination of a large number of specimens, that these thin chitinous valves were ornamented by raised lines upon their outer surface, as are the valves of the modern *Estheria*.

Loc. and Horizon.—Penwhapple Burn, at bend below Penkill Castle (*Coll. Geol. Survey Scot.*); collected by Mr A. Macconochie.

Genus DICTYOCARIS, Salter, 1860.

(Annals Nat. Hist., 1860, v. p. 161.)

Dictyocaris (?), *sp. ind.*

Dictyocaris, sp., Etheridge jun., Mem. Geol. Survey Scot., Expl. 3, 1873, p. 34.

Obs.—The occurrence of this genus at Girvan depends upon the determination by one of us of a specimen which appeared to possess the peculiar sculpture described by Mr Salter. It is not now available, and the determination requires confirmation.

¹ Quart. Jour. Geol. Soc., 1863, xix. p. 88, woodcut.

Loc.—Quarry near Knockgardner, about ten miles north-east of Girvan (*Coll. Geol. Survey of Scotland*); collected by Mr A. Macconochie.

Sub-class CIRRIPIEDIA.

Order THORACICA.

Genus TURRILEPAS, H. Woodward, 1865.

Plumulites, Barrande (MS.), in Reuss, Sitz. Berichte d. K. Akad. d. Wissensch. 1864, xlix. p. 215 (note 2).

Turrilepas, H. Woodward, 1865, Quart. Jour. Geol. Soc., xxi. p. 486.

Plumulites, Barrande, 1872, Syst. Sil. Boh., i., Suppl., p. 565.

Oploscolex, Salter, 1873, Cat. Camb. and Sil. Foss. Woodwardian Mus. Camb., p. 129 (*fide* Morris).

Turrilepas, H. Woodward, 1877, Cat. Brit. Foss. Crust., p. 143.

„ R. Etheridge, jun., 1878, Proc. R. Phys. Soc. Edin., iv. p. 164.

Obs.—A short time ago one of us wrote as follows regarding this genus :—

“ The genus *Turrilepas* was established by Dr H. Woodward, F.R.S., for certain peculiar ovate triangular plates from the Dudley limestone, previously known under the name of *Chiton Wrightianus*, de Koninck. Dr Woodward satisfactorily showed that these plates were more properly referable to a form of *Cirripedia* allied to the recent *Loricula*, and for which he proposed the name *Turrilepas*, than to *Chiton*, or to any other Mollusc. Priority is claimed by M. Barrande for his term, on the plea of previous publication. For my own part, I hardly think the facts support M. Barrande’s claim. Dr Woodward’s name was both proposed and published in 1865; and although the genus was certainly not defined in so many words, it was nevertheless founded on a well-known and perfectly-defined fossil, and what is more, was copiously illustrated. I take this to be satisfactory publication. It appears that M. Barrande had discovered similar plates in the Silurian rocks of Bohemia, and applied to them the name *Plumulites*,—a fact which was communicated by Professor Reuss to the Imperial Academy of Science of Vienna at their meeting of 18th February 1864, and

was published in a paper of the latter,¹ but unaccompanied either by description or figure. The plates in question were referred by M. Barrande to the *Cirripedia*, and their alliance to *Loricula* pointed out; but so far as I understand the question, no description or figure was furnished by the latter until the appearance in 1872 of the supplement to the first volume of his magnificent work on the 'Silurian System of Bohemia.'² I think, under these circumstances, that strict impartiality requires the adoption of Dr Woodward's *Turrilepas*. Again, Messrs Hall and Whitfield³ adopt *Plumulites* in preference to *Turrilepas*, on the ground that the latter was never characterised; but my previous remarks equally apply in this case."

***Turrilepas Scotica*, R. Etheridge, jun.**

(Pl. XIV., figs. 22-27.)

T. Scotica, Eth. jr., Proc. R. Phys. Soc. Edin., 1878, iv. p. 166, t. 2, f. 1 and 2.

Spec. char.—General form elegantly kite-shaped, curved; superior end curved and much attenuated, produced into a fine needle-point; inferior margin slightly convex, and a little concave in the middle; lateral margins, one convex throughout the whole of its length, the other and opposite one convex in the lower part gradually becoming concave towards the finely drawn out superior end; lobation very indistinct, only traceable through the curvature of the transverse striæ; a median, ridge-like, sharp, and narrow keel, dividing the plate into two sub-equal parts, passes from the central concavity of the inferior margin to the sharp superior extremity—the latter is, in fact, formed by the extension of this central keel, the plate on each side of it becoming abortive; surface ornamented with a very large number of transverse imbricating striæ, which in the central lobe are parallel to the inferior margin, and on the lateral lobes are bent down parallel to the lateral margins.

¹ Sitz. Berichte d. K. Akad. d. Wissensch, xlix. p. 215.

² Système Silurien du Centre de la Bohême, Supp. vol. i., 1872, p. 565.

³ Ohio Geol. Report, ii. pt. 2, p. 106.

Obs.—*T. Scotica* differs from the Dudley *T. Wrightii*, de Koninck, in form and proportion, in the much augmented number of concentric striæ, and particularly in the extended superior extremity. The same characters also appear to separate it from all the species described by M. Barrande.

That our figures do not represent merely one form of plate out of the several which occur in the body of *Turrilepas*, is, we think, proved by a specimen in the collection, which shows a number of them associated together, after the manner of Dr Woodward's fig. 1,¹ and all retaining the outline and characters above described. Out of the three-and-twenty individual specimens before us, all, with the exception of five, assume the elongate form we figure. Of the latter, two (Pl. XIV., figs. 25 and 26) approach much nearer in form to the typical outline of the plates of *T. Wrightii*,² and had a wavy inferior margin, indicated by the lines on the surface, as in de Koninck's species. The third example (Pl. XIV., fig. 27) corresponds with those pieces in the economy of *Turrilepas* described by M. Barrande as the "cancellated plate" (*valve fenestrée*),³ and in which the apex is rounded and depressed, the surface concentrically ornamented, and the outline of the plate somewhat wedge-shaped. The fourth and fifth plates differ somewhat in form from the two previously noticed, but correspond in every way to those denominated by M. Barrande the "large valve" (*valve large*).⁴

Whether figs. 24-27, Pl. XIV., are plates in the test of our species *T. Scotica*, we are at present uncertain, but in all probability the "cancellated plate" is so. In the Museum of Practical Geology are some "cancellated plates" from the Deerhope Burn, Pentland Hills, which closely resemble that from Girvan. To these Mr Salter applied the MS. name *T. Haswelli*.

Loc. and Horizon.—Balcletchie, in a fine-grained greenish mudstone. (Gray Collection.)

¹ *Loc. cit.*, t. 14.

Syst. Sil. Boh., i., Suppl., p. 567.

² *Ibid.*, f. 1*i*, *k*, *l*.

⁴ *Ibid.*, Atlas, t. 20, f. 4^a and 5^b.

Order OSTRACODA.

We are indebted to Professor T. Rupert Jones, F.R.S., F.G.S., &c., for the following notes on the Silurian Ostracoda which have been met with in the Girvan area up to the present time.

Genus CYTHERE, O. F. Müller, 1785.

(Entomostraca, seu Insecta Test., pp. 34 and 63.)

Cythere aldensis, M'Coy.

(Pl. XV., figs. 1-3.)

Cytheropsis aldensis, M'Coy, Annals Nat. Hist., 1851, viii. p. 387.

Cythere aldensis, Jones and Holl, Annals Nat. Hist., 1868, ii. p. 60, t. 7, f.

12. (For synonymy.)

Cytheropsis aldensis, Bigsby, Thes. Siluricus, 1868, p. 74.

„ „ Woodward, Cat. Brit. Foss. Crust., 1877, p. 114.

Spec. char.—Carapace haricot-shaped, thin at the edges; rather wider at one end than the other; hinge on the convex edge, marked by a simple apposition of the edges of the valves. The surface roughened by partial dissolution; but a roughish circular elevation is sometimes apparent in the anterior third, as is seen also in Professor M'Coy's first sketch.¹ This comes rather far forward, but may be the usual muscle-spot.

Loc. and Horizon.—Plentiful in the greenish-black and black limestone of Aldens; (?) in the fine-grained greenish sandstone of Thrave Glen. (Gray Collection; *Mus. Pract. Geology*; *Woodwardian Mus. Cambridge*, &c. &c.)

C. aldensis (M'Coy), var. *major*, Jones.

(Pl. XV., fig. 4.)

Obs.—This agrees with the foregoing in the general shape of the carapace-valves, but is larger, and may be a sex variety.

¹ Brit. Pal. Foss., t. 1, L. f. 2.

The relative convexity of the sides cannot be determined, for the valves of our specimens are more or less cracked by pressure, and partially crushed.

Loc. and Horizon.—Aldens, in greenish-black limestone. (Gray Collection.)

Cythere Grayana, Jones (*sp. nov.*)

(Pl. XV., figs. 5-5^b and 6-6^b.)

Spec. char.—Valves nearly oblong, with rounded, nearly equal ends, and very slightly arched dorsal, and faintly incurved ventral, edge. Surface highly convex; a faint submedian circumscribed elevation (muscle-spot), with a very shallow transverse furrow in front of it, occurs on one specimen. The furrow is much more thoroughly impressed on the internal casts of the valves.

Obs.—Although somewhat obscure, as are many of the Palæozoic Entomostraca, this form appears to be sufficiently distinct from others to require a classificatory appellation, and we propose to associate it with the name of Mrs Robert Gray, to whose labours in the geology and palæontology of Girvan these pages owe their origin.

Loc. and Horizon.—Aldens, in black and greenish-black limestone. (Gray Collection.)

Cythere Wrightiana, Jones and Holl.

(Pl. XV., figs. 7-7^b.)

C. Wrightiana, J. and H., Annals Nat. Hist., 1868, ii. p. 57, t. 7, f. 5.

„ „ Woodward, Cat. Brit. Foss. Crustacea, 1877, p. 108.

Obs.—This has more equal ends than *C. aldensis* possesses, is less convex on the sides, and more parallel above and below.

Loc. and Horizon.—Rare in the greenish-black pyritous limestone of Aldens. (Gray Collection.)

Genus BEYRICHIA, M'Coy, 1846.

(Sil. Foss. Ireland, p. 57; Brit. Pal. Foss., 1851, fas. 1, p. 135.)

Beyrichia Klædeni, M'Coy.(Pl. XV., figs. 8-8 $\frac{1}{2}$.)*B. Klædeni*, M'Coy, Sil. Foss. Ireland, 1846, p. 58, woodcuts.

,, M'Coy, Brit. Pal. Foss., 1851, fas. 1, p. 135, t. 1, E. f. 2.

B. tuberculata, Salter, Mem. Geol. Survey, 1848, ii. pt. 1, p. 352, t. 8, f. 14, 15.*B. Klædeni* (granulated var.) Jones, Annals Nat. Hist., 1855, xvi. p. 166, t. 6, f. 7, 9.,, *et varr.*, Jones, Proc. Geol. Assoc., 1869, pp. 11 and 14, woodcuts.

,, H. Woodward, Cat. Brit. Foss. Crust., 1877, p. 84.

Spec. char.—Surface of valves three-lobed, bordered anteriorly, ventrally, and posteriorly by a marginal rim. The hind and front lobes are large and pyriform; the centre lobe is ovate, more or less closely united by a peduncle with the upcurved end of the posterior lobe. The valleys and lobes are variable in depth and breadth, and the lobes also are divided in some cases into lobules; the surface is often granulated.

Obs.—This Upper Silurian species is represented in Mrs Gray's collection by one hollow mould of the external surface, in the greenish fine-grained sandstone of Thrave Glen; it corresponds especially with M'Coy's figured variety.¹ *B. Klædeni* was first met with in the Girvan district by Mr A. Macconochie, of the Geological Survey of Scotland.

Loc. and Horizon.—Thrave Glen, as above (Gray Collection); Hillside, near Blair Farm, about 8½ miles north-east of Girvan,² and a variety at a quarry on the roadside at Knockgardner, about ten miles north-east of Girvan (*Coll. Geol. Survey of Scotland*).³

¹ Brit. Pal. Foss., t. 1, E. f. 2.² Mem. Geol. Survey Scotl. Expl. 3, 1873, p. 34.³ Ibid.

Beyrichia impendens, Jones.(Pl. XV., figs. 10-10^c.)

B. impendens, Jones, Palæoz. Biv. Entom. (Proc. Geol. Assoc.), 1869, p. 11,
figs. 4a, 4b.

„ Proc. Edinburgh Geol. Soc., vol. ii. pt. 3, 1874, p. 322.

„ Geol. Mag., 1874, ser. 2, vol. i. p. 511, figs. 2a, 2b.

Spec. char.—A small variable *Beyrichia*, known from casts and impressions; rarely from well-preserved, mostly from squeezed and distorted, individuals. The surface of the valves has a large pyriform posterior, and a much smaller anterior lobe, with a very small subcentral lobe in the broad median valley, but usually lying against the inside edge of the front lobe. In these features it approaches both *B. Salteriana* and *B. Klædeni*; but the neatness, ornamentation, and rim of the former are distinctive; and in the old condition (with antero-ventral additional lobe) the latter and *B. impendens* have different shapes (see Pal. Biv. Entom., *supra cit.*, figs. 4 b and 6 b).

Obs.—This weak little *Beyrichia* is very much altered in the schistose state, in which it is usually found; the central sulcus and its little tubercle having been squeezed fore and aft, and sometimes crumpled so as to give two tubercles. As variation of growth may have had to do with some of these differences, the form with two little knobs has been termed var. *tuberosa* (see Proc. Edin. Geol. Soc. and Geol. Mag., *loc. cit.*)

Loc.—*B. impendens* has been found by Mr A. Macconochie at the Hillside, opposite Blair Farm, about 8½ miles north-east of Girvan (*Coll. Geol. Survey of Scotland*).

Beyrichia comma, Jones (*sp. nov.*)(Pl. XV., figs. 9-9^c.)

Spec. char.—Valves straight on the dorsal edge, obliquely elliptical on the ventral edge; much flatter and wider at one

end than the other. On the middle third of the surface is a semicircular ridge-like lobe, convex downwards, having one of its horns thicker than the other, and curved and rounded with a knob against the hinge-line. Ventral aspect of the closed carapace broad-lance-shaped; end view of the thickest and narrowest portion (? anterior) sub-cordate.

In other words, the surface may be described as being impressed with three cross valleys,—one long, and sloping from the posterior (?) dorsal region forwards to the ventral border; the second, medial, shorter, and deeper, curving rapidly forwards; and the third, on the most convex (anterior?) third of the valve, is quite forward and shallow, and curves backward.

Obs.—We do not know any *Beyrichia* like this; but possibly *B. venusta*, Billings, from Anticosti, may be somewhat similar, judging only from the description given in the 'Catalog. Silur. Foss. Anticosti,' p. 68. A figure of a *Beyrichia* in Haswell's 'Geology of the Pentland Hills,' 1865, Pl. 3, fig. 12, has at first sight some resemblance to our species; but it is really intended for *B. Klædeni*.

Loc. and Horizon.—*B. comma* is represented by several specimens crowded together in a little nest-like group, with a *Cythere* (somewhat like *C. aldensis*), in the greenish fine-grained sandstone of Thrave Glen. (Gray Collection.)

Genus PRIMITIA, Jones and Holl, 1865.

(Annals Nat. Hist., 1865, xvi. p. 415.)

Primitia Barrandiana, Jones (*sp. nov.*)

(Pl. XV., figs. 11-11^f.)

Spec. char.—Valves oblong-ovate, straight on the hinge-line, well rounded fore and aft and below. Surface of shell more convex on one half than on the other, and undulating with three obscure depressions—one on each third of the surface. The middle valley is deepest, and is marked by a faintly-raised

spot. The cast of the inside of the valve is far more deeply furrowed by a decided sulcus, from the hinge-line to the middle of the valve; and there is a very faint trace of a more anterior depression.

There are some individuals larger than the others, and they show only a feeble middle dorsal depression; but their internal casts show it more strongly.

Obs.—It is very difficult to correlate these simple *Primitiæ*, for the individuals among a large number vary very much.

These *Primitiæ* from Girvan evidently belong to the same set as those enumerated at p. 223, Ann. Mag. Nat. Hist., ser. 4, vol. iii., as Lower Silurian forms; and, of course, to the similar series from the 'Faune Silurienne, No. II.,' in M. Barrande's 'Syst. Silur. Bohême' (Suppl. to vol. i., 1872, p. 542). Similar forms occur also in North America (Newfoundland and Ohio). It is difficult, however, to fix an exact relationship between the Girvan specimens and any of those alluded to above. Looking at those species which are well known by their valves, or by impressions of their valves (not by internal casts only), we find many gradations in shape, from semicircular to oblong, and from a sulcated to an even or but slightly undulated surface. We may note that the surface may be nearly even, and yet a sulcus may appear on the internal cast. Smoothness, or a pitting of the surface, and the presence or absence of a marginal rim, are other and more definite characteristics.

The neat and almost Leperditoid outline, the smooth, undulated surface, with its minute median knoblet, and the definite dorsal transverse sulcus on the cast (due to a thickening of the middle of the valve), are characters which we do not find together in any named *Primitia*.

Barrande's *P. prunella* is not far removed; but it has an external sulcus and pitted surface; and so has *P. Logani*, Jones. *P. simplex*, Jones, is not sufficiently oblong; its external aspect is not well known, and the sulcus on the cast is not neatly defined. *P. mundula*, Jones, is nearly oblong;

but it is punctate, margined, and sulcated externally. *P. renulina*, Jones and Holl, is oblong, smooth, margined, and strongly notched. *P. Beyrichiana*, Jones and Holl, is oblong, smooth, and very faintly marked by the sulcus; but it is broadly margined with an ornamented ventral rim. *P. matutina*, Jones and Holl, is too long and smooth; *P. pusilla*, Jones and Holl, too circular and flat, though somewhat undulate. *P. obsoleta*, Jones and Holl, is nearer in its relative convexity; but it is semicircular and rimmed. Others disagree in form or other feature; and, since we have both the valves and the inner cast to give us as clear a knowledge as we are likely to get of this *Primitia*, we propose to give it a name (*P. Barrandiana*), associating it with the distinguished palæontologist of Bohemia, M. Joachim Barrande, who has elucidated so very many of its congeners.

At p. 221, 'Ann. Nat. Hist.,' ser. 4, vol. iii., are figured some casts of *Primitia* from the Shineton shales of Shropshire; and one of these, fig. 7, resembles in outline our *P. Barrandiana*, from Aldens, and may, indeed, be a poor representative of this species. Further, Dr C. Callaway has submitted for examination some specimens from the same shales, and these correspond generally with the same form; and though the transverse furrow is absent in one, it is represented by a mere dot in another, and by a definite sulcus in a third. These are mere flattened casts of outspread pairs of valves, which, varying in the semicircularity of their outlines, range between the shapes of figs. 6 and 7 ('Ann. Nat. Hist.,' *loc. cit.*); indeed, specimens like fig. 7 occur with them. They are alluded to by Dr Callaway in his paper in the 'Quart. Journ. Geol. Soc.,' 1877, vol. xxxiii. p. 670, where he refers these shales to the horizon of the "Lingula-flags." We may regard these little *Primitia* as small, modified, and crushed individuals, belonging to *P. Barrandiana*.

Loc. and Horizon.—*P. Barrandiana* occurs in the greenish-black pyritous limestone, and the black, friable, slickensided limestone of Aldens. In some pieces it is abundant, with

but few *Cytheræ*; in others, scattered in company with many individuals of *Cythere Aldensis*, &c. (Gray Collection.)

Genus ENTOMIS, Jones, 1861.

(Mem. Geol. Survey Scotl., No. 32, p. 137.)

Entomis globulosa, Jones (*sp. nov.*)

(Pl. XV., figs. 12*a* and *b*.)

Obs.—The subconical or nearly hemispherical fossil, with a somewhat oval base-line ($\frac{1}{8} + \frac{1}{12}$ inch), here figured, is an internal cast (in mudstone) of a tent-like shell, carapace, or valve, of doubtful relationship. I believe it to be an Entomostracan valve. It is referred to in the 'Mem. Geol. Surv. Scotland; Explan. Sheet 3, Western Wigtonshire,' 1873, p. 34, as having been found (about 1872) in the soft grey micaceous mudstone (weathering rusty) of the "Hillside opposite Blair Farm, about eight and a half miles north east of Girvan," and as having an analogue in some better preserved specimens from the Pentland Hills.

In the Girvan specimen, which is in the Collection of the Geol. Surv. Scotl. and marked "M. 1920," an apical depression, not quite central, is continued a little way on the longer axis of the cast by a tapering furrow. Studied in the light given by some other Entomides, this appears to me to be the cast of a valve of a very globose *Entomis*; and that it has been squeezed from end to end, so that the long and short axes have been mutually interchanged. The better specimens are considered as typical of a new species, *Entomis globulosa*.

GENERAL REMARKS UPON THE CRUSTACEA OF THE GIRVAN AREA.

In our First Fasciculus we gave, after the description of the Corals, a few general remarks on the stratigraphical relations of the species as a whole, more especially in regard to the

evidence furnished by them of the age of the beds in which they occur.

We now purpose supplementing this by a few remarks on the evidence afforded by the Trilobites and other Crustacea, and contrasting it with that deduced from our study of the Coral fauna.

The first point which strikes the observer is the increase in the number of localities yielding Trilobites, or other orders of Crustacea, over those from which Corals have been obtained. Whether this will maintain itself after the additional researches amongst the Girvan Corals, upon which we are at present engaged, remains to be seen. It is, however, noteworthy, that at certain localities where the Coral fauna has been found to be copious, the Crustacea were correspondingly scarce, and *vice versa*.

So far as possible, we take the localities in the order in which they are considered in our previous notes.

I. CRAIGHEAD LIMESTONE AND SHALE.—These distinct and interesting beds have yielded the following Trilobites :—

Calymene Blumenbachii, Brong.

Bronteus (large sp.)

Cheirurus gelasinus, Portlock.

Encrinurus punctatus, Brunn., var. *arenaceus*, Salter.

Illænus Bowmani, Salter.

„ *Rosenbergi*, Eichwald (?).

Lichas Hibernicus, Portlock.

We have here seven species, appertaining to six genera. Now, one of these is rather a doubtful determination, and on it we would not place too much reliance, although we believe the species to be identical with that known as *Illænus Rosenbergii* in this country. To resume, then, we have two, out of the four satisfactory species, which are essentially Caradoc—viz., *Ch. gelasinus* and *Lichas Hibernicus*. In *Ill. Bowmani*, on the other hand, we have a Trilobite with an extended range in time, as it is said to occur as high as the Upper Ludlow, although its culminating point may be said to be in the Caradoc,

or Llandovery rocks. The late Mr Salter remarked, "This species never occurs in Wenlock rocks, and but rarely so high as the May Hill Sandstone."¹ Evidence derived, however, since Salter wrote, appears to demand a modification of this statement to some slight extent. In the presence of the var. *arenaceus* of *E. punctatus*, we have a form regarded as truly typical of Llandovery rocks,² although it ranges as high as the Wenlock. On this point we cannot do better than again quote Mr Salter, who says that it occurs in the Upper Caradoc in great abundance, and is again common in the *Pentamerus* limestone.³

Thus, we have in the Craighead limestone and associated shale two species typically Caradoc, another which has its culminating point at or about that horizon, a third species which appears to be a representative of a somewhat higher zone, and if the doubtful species is taken into account, yet another form restricted in its range to the Caradoc.

To a certain extent this evidence bears out our previously expressed opinion, that the Craighead limestone is not of Upper Silurian age, although it scarcely assigns to this stratum so low a position as that derived from a study of the Corals.

II. MULLOCH HILL BEDS.—The Trilobites from the deposits at this locality rarely ever have the true integument preserved, but, like the Corals, are usually in the state of casts. In the following list of species, four are inserted on the authority of Messrs Salter and M'Coy—viz., *Acidaspis callipareos*, *Phacops Stokesii*, *Cyphasps megalops*, and *Trinnucleus concentricus*; of actual specimens of these we have not seen definite evidence. The full list is as follows :—

Acidaspis callipareos, Wyv. Thomson.
Calymene Blumenbachii, Brong. var.
Cheirurus bimucronatus, Murchison.
Cyphasps megalops, M'Coy.
Illænus Macallumi, Salter.
 „ *nexilis*, Salter.

¹ Monograph, p. 187.

² Siluria, p. 90.

³ Decade vii. No. 4, p. 7.

Illænus Rosenbergi, Eichwald (?).

„ *Thomsoni*, Salter.

Lichas Barrandei, Fletcher (?).

Phacops Brongniarti, Portlock.

„ *Stokesii*, M. Edwards.

Trinucleus concentricus, Eaton.

Omitting the four species above mentioned, we have to take into consideration the remaining eight forms, of which two are doubtful determinations—viz., *Illænus Rosenbergi* and *Lichas Barrandei*. Amongst the others is a typical Caradoc form—viz., *Phacops Brongniarti*; whilst *Calymene Blumenbachii*, from its extended range, might at first be regarded as of little value, but it is to be remarked that its range as a Caradoc fossil is limited, whilst in the Lower Llandovery and May Hill beds its occurrence is much more extended, and it culminates in the Wenlock shale and limestone, of which it is very characteristic. *Illænus Thomsoni* is a Llandovery species, both upper and lower; but *I. nexilis* can scarcely be considered as of much value in a stratigraphical sense, as it is a purely local form. *Illænus Macallumi* was considered by Mr Salter to be indicative of Lower Llandovery age.¹ Of the four species recorded from the Mulloch Hill beds, which we have not seen, *Phacops Stokesii* commences its range in the Llandovery and passes upwards; *Acidaspis callipareos*, although a local species, is said to be of a Caradoc facies; *Cyphaspis megalops* makes its first appearance in the Caradoc, occurs in the Upper Llandovery, and passes up; whilst *Trinucleus concentricus* is both Caradoc and Upper Llandovery. Taking, therefore, the general facies of the whole Trilobite fauna of the Mulloch Hill beds, the expression made use of by us in referring to the Corals of this locality almost equally applies to the present class, “that the Mulloch Hill beds are certainly referable to the Upper Silurian.” Further than this, it is very probable that either the Lower or Upper Llandovery has the strongest claim. Mr Salter placed them with the former, from the absence of *Pentamerus*.

¹ Monograph, p. 211.

III. PENKILL BEDS.—From the greenish-grey mudstone of Penkill we possess eight species—

- Calymene Blumenbachii*, Brong. (?).
Cheirurus trispinosus, Young.
Bronteus Andersoni, Eth. jun. and Nich.
Encrinurus punctatus, var. *calcareus*, Salter.
 „ „ „ *arenaceus*, Salter.
Illænus æmulus, Salter.
 „ *Bowmani*, Salter.
 „ *Murchisoni*, Salter.
 „ *nexilis*, Salter (?).

The Corals of the Penkill beds tended to prove the deposit in question to be situated towards the lower part of the Upper Silurian. Beyond the evidence afforded by the genera, the species *Cheirurus trispinosus* and *Bronteus Andersoni* cannot be said to prove anything, being peculiar to the beds; and the same may be said of *Illænus nexilis*. The variety *calcareus* of *Encrinurus punctatus* is very characteristic of the Wenlock limestone, whilst *Illænus æmulus* is essentially an Upper Llandovery species. The fourth species of *Illænus*, *I. Murchisoni*, is stated by Mr Salter to be almost confined to rocks of Caradoc age in Wales. Lastly, we have the evidence of the genus *Bronteus*—a very characteristic one of the Penkill beds, and which, with few exceptions, is an Upper Silurian genus.

We have, then, in these greenish mudstones, a mingling of species—some found high up in the Silurian series, but the majority indicating the lower part of the Upper Silurian, such as the Upper Llandovery or May Hill Sandstone, as the probable horizon to which the Penkill beds should be assigned.

IV. BALCLETCHIE.—At this locality two deposits of a different nature occur, yielding Trilobites and other Crustacea: (a) a coarse, volcanic, greenish-coloured ash; and (b) a dark-greenish mudstone.

(a) In the former, three species of Trilobites have been met with: one a widely-spread and very characteristic Caradoc species, *Sphærexochus mirus*, Beyr.; and two others peculiar to the district under description—viz., *Staurocephalus* (?) *unicus*

and *Acidaspis Lalage*. Both the latter are said by our best authorities also to have a Caradoc facies.

(b) In the Balcletchie mudstone we have, without doubt, the most copious Trilobite fauna of the Girvan area, so far as our present researches have gone, comprising in all fourteen species, viz.:—

- Acidaspis Grayæ*, Eth. jun.
- „ *hystrix*, Wyv. Thomson.
- Ampyx Hornei*, Eth. jun. and Nich.
- „ *Macallumi*, Salter.
- „ (?) *Macconochiei*, Eth. jun. and Nich.
- Agnostus agnostiformis*, M'Coy.
- Asaphus gigas*, De Kay (?).
- Bronteopsis Scotica*, Salter.
- Cheirurus gelasinus*, Portlock.
- Cybele verrucosa*, Dalman.
- Illænus Bowmani*, Salter.
- Lichas Hibernicus*, Portlock.
- Remopleurides Barrandei*, Eth. jun. and Nich.
- Salteria primæva*, Wyv. Thomson.

And of other Crustacean groups—

- Pinnocaris Lapworthi*, Eth. jun.
- Turrilepas Scotica*, Eth. jun.

Seven of the above Trilobites are species unknown elsewhere than in the Girvan area, and from a specific point of view will be of little service in determining the age of the beds in question, except in so far as pointing to allied species elsewhere. Irrespective of these, we have, first, four typically Caradoc species—viz., *Cheirurus gelasinus*, *Lichas Hibernicus*, *Asaphus gigas*, and *Agnostus agnostiformis*. In company with these we find a Caradoc and Llandovery form, *Cybele verrucosa*, the ever-occurring *Ill. Bowmani*, and *Salteria primæva*, a Llandeilo species. The *Remopleurides*, although a new species, is one worthy of much consideration, for throughout the whole of the British Silurian rocks all the species of *Remopleurides* are Caradoc, and Caradoc only.

With regard to the other new species, we have this evidence: The genus *Ampyx*, with very few exceptions, is one confined to the Lower Silurian, and is either Llandeilo or

Caradoc; whilst *Acidaspis* ranges higher, and is stronger in species in the higher portions of the Silurian system. On the other hand, the new genus *Bronteopsis*, from its relation to *Barrandia* and its connection with the Ogygidæ, may be considered rather a low type. Another interesting fact in connection with the Balcletchie fauna must not be overlooked—the occurrence amongst so many Caradoc forms of that very characteristically Upper Silurian fossil, *Turrilepas*. In the Silurian rocks of our own country it is a Wenlock species, the type *T. Wrightii* being found at Dudley; whilst an undescribed species, probably not far removed from *T. Scotica*, is met with at about a similar horizon in the Pentland Hills. In Bohemia, where the genus is far more largely represented than here, both as regards individuals and species, it is met with in Barrande's 'Étages,' D. 1, D. 4, and D. 5, or beds about equivalent to our Tremadoc, Caradoc, and Llandovery respectively.

Now, from the Balcletchie mudstone we have few or no Corals of any importance, and those from the ash or fine conglomerate scarcely give a clue to the age of the deposit. Looking, however, at the above Trilobite fauna as a whole, one cannot but be struck with the strong Caradoc facies presented by it, though, at the same time, this is tempered by the presence of a few forms equally typical of other horizons.

V. ARDMILLAN BRAE.—This locality has yielded—

Asaphus gigas, De Kay (?).

Bronteus Andersoni, Eth. jun. and Nich.

Illenus Bowmani, Salter.

Phacops Brongniarti, Portlock.

Remopleurides laterispinifer, Portlock.

Staurocephalus globiceps, Portlock.

Little need be said about these Trilobites, as they almost speak for themselves. The first and three last are, as we have before had occasion to remark, typically Caradoc; the third has a lengthened range; whilst on the presence of the *Bronteus* we do not put great reliance, the specimen obtained by the Geological Survey being a single one.

VI. PENWHAPPLE.—The matrix at this locality more or less resembles that at Balclatchie. The following species have been met with here :—

Acidaspis Lalage, Wyv. Thomson.
Agnostus agnostiformis, M'Coy.
Ampyx Macallumi, Salter.
Asaphus radiatus, Salter.
Bronteopsis Scotica, Salter.
Cheirurus clavifrons, Dalman.
Cybele verrucosa, Dalman.
Encrinurus punctatus, var. *arenaceus*, Salter.
Illænus Bowmani, Salter.
Salteria primæva, Wyv. Thomson.
Staurocephalus (?) *unicus*, Wyv. Thomson.

Our remarks on the Balclatchie fauna almost equally apply here. The Caradoc forms are *Cheirurus clavifrons*, *Staurocephalus* (?) *unicus*, *Asaphus radiatus*, *Agnostus agnostiformis*; whilst *Acidaspis Lalage* and *Bronteopsis Scotica* are probably also indicative of the same age.

VII. DRUMMUCK.—Without doubt this is the second most prolific locality for Trilobites in the Girvan district, for we have examined no less than sixteen species, viz. :—

Ampyx rostratus, Sars.
Calymene Blumenbachii, Brong.
Cheirurus bimucronatus, Murchison.
 „ *clavifrons*, Dalman (?).
Cybele rugosa, Portlock.
 „ *verrucosa*, Dalman.
Dindymene Cordai, Eth. jun. and Nich.
Illænus Bowmani, Salter.
Lichas Geikiei, Eth. jun. and Nich.
 „ *Grayi*, Fletcher.
Phacops Brongniarti, Portlock.
Proetus Girvanensis, Eth. jun. and Nich.
 „ *procerus*, Eth. jun. and Nich.
Remopleurides Colbii, Portlock.
Staurocephalus (?) *unicus*, Wyv. Thomson.
Trinucleus seticornis, var. *Bucklandi*, Barrande.

The first point which strikes us in connection with this list of species is the presence of so few forms indicative of an

absolutely low horizon in the Lower Silurian, and the preponderance of those species occurring in and about the Caradoc and Llandovery rocks. Thus, for instance, *Calymene Blumenbachii*, *Illænus Bowmani*, and *Ampyx rostratus* are the only species which are found as low as the Llandeilo, whilst they all three occur in the Caradoc with *Cheirurus clavifrons* (?), *Cybele rugosa*, *Staurocephalus* (?) *unicus*, *Remopleurides Colbii* (?), *Phacops Brongniarti*, and *Trinucleus seticornis*, which are all exclusively Caradoc. Of the other species, *Cheirurus bimucronatus* ranges from the Caradoc to the Aymestry beds; *Cybele verrucosa* is both Caradoc and Lower Llandovery; *Lichas Grayi*, a doubtful determination, is confined to the Wenlock elsewhere; whilst *Calymene Blumenbachii*, although possessing an extended range, is, as we have before observed, particularly characteristic of the Lower Llandovery and May Hill Sandstone.

We now come to the genus *Proetus*, which, although represented by new species, is of some importance as a test of the age of the Drummuck beds; because, with us, it has been found to be either an Upper Llandovery or Wenlock genus—perhaps more characteristic of the latter than the former. The deposit has, as yet, yielded two species of *Lichas*—a genus occurring in British Silurian rocks, chiefly in the subdivisions of the Caradoc and Wenlock; but here, again, numerically stronger, as to species, in the Upper than the Lower Silurian.

The curious genus *Dindymene*, which has not hitherto been recorded as British, is Lower Silurian in character. The form which we referred to *Phacops truncato-caudatus*, in our First Fasciculus, our friend Mr C. Lapworth thinks may turn out to be a *Dionide*. Circumstances have prevented our going into this question again as yet; but if it should prove to be so, it will add another Lower Silurian genus to the Drummuck fauna.

On the whole, it appears to us—taking a broad view of the question—that the Drummuck beds will probably turn out to be of Lower or Upper Llandovery age—speaking simply from

the evidence afforded by the Trilobites,—a question, however, which will in a great measure be dominated or modified by the Mollusca found in company with them.

VIII. THRAVE GLEN.—The following Crustacea have been here met with :—

Cheirurus clavifrons, Dalman (?).

Lichas laxatus, M'Coy.

Beyrichia comma, Jones.

„ *Klædeni*, M'Coy.

Cythere Aldensis, M'Coy (?).

The first of the Trilobites mentioned is a Caradoc species ; the second occurs in the Caradoc, and both the Lower and Upper Llandovery. *Beyrichia comma* is a new species, and not of much moment in determining the age of the beds ; but *B. Klædeni* is a well-known form, and ranges from the Llandovery upwards. But if we may judge from its rarity at this locality, its occurrence would probably indicate Llandovery beds rather than those above.

IX. ALDENS.—The black or dark-coloured limestone of Aldens had, up to the time Mrs Gray commenced her researches at Girvan, yielded only one Ostracode—*Cythere* or *Cytheropsis Aldensis*, M'Coy. In the blocks of limestone forwarded to Professor T. Rupert Jones, F.R.S., the latter has now been able to recognise a well-marked variety, and three other species, of which descriptions have been previously given. The full list is as follows :—

Cythere Aldensis, M'Coy.

„ „ var. *major*, Jones.

„ *Grayana*, Jones.

„ *Wrightiana*, Jones.

Primitia Barrandiana, Jones.

The Aldens limestone was considered by Professor M'Coy to be of Lower Bala age,¹ and the number of species of the genus *Cythere* which Professor Jones has been able to detect, will go far to support this view ; for the genus appears to be,

¹ Brit. Pal. Foss., p. 351.

in Silurian rocks, essentially characteristic of the Lower Silurian series.¹ The only other fossil at present published from this limestone is a *Maclurea*, again a low form, and affording still further support to M'Coy's view.

X. HILLSIDE, NEAR BLAIR FARM.—Mr A. Macconochie, of H.M. Geological Survey, has collected a few Ostracoda at this locality, which Professor T. R. Jones was kind enough to determine as—

Beyrichia Klædeni, M'Coy.

„ *impendens*, Jones.

Although only two in number, the above species are important, and for this reason: *B. Klædeni* is exceedingly characteristic of the Lesmahagow beds, high in the Upper Silurian series, whilst the other species is equally distinctive of similar beds in the Pentland Hills. Add to this, that they are accompanied by a *Retiolites*, amongst other fossils, and we have in all probability presumptive evidence of beds higher in the Silurian series than any we have yet had to consider.

XI. KIRKHILL.—Three species only have been obtained here, viz. :—

Illeenus Bowmani, Salter.

„ *Macallumi*, „

„ *Thomsoni*, „

The two last both occur at Mulloch Hill, and in all probability the Kirkhill beds are about the same horizon as those at the former locality.

The following table shows the geographical distribution, in the Girvan district, of the whole of the Crustacea occurring there, with which we are at present acquainted. The genera and species are arranged alphabetically.

¹ Bigsby's Thes. Siluricus, p. 73.

GEOGRAPHICAL DISTRIBUTION OF THE CRUSTACEA IN THE GIRVAN DISTRICT.

GENERA AND SPECIES.	Drumuck.	Mulloch Hill.	Lady Burn.	High Maids.	Kirk Hill.	Rough Neck.	Thrive Glen.	Craighead Quar.	Penhapple Burn.	Baldclachie.	Piedmont Glen.	Ardmillan Brae.	Penkill.	Ardwell.	Aldens.	Shalloch Mill.	Blair Farm.	Bargany Pond.	Sinchar River.	Knockdolian.	Saugh Hill.	Cuddystone Glen.	Knockgardner.
<i>Trilobita</i> —																							
<i>Acidaspis caliparceus</i> . Wyr. Thomson,	..	x	..	..	..	..	..	..	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..
Graye. <i>Eth. jun.</i>,	..	..	..	..	..	..	..	..	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..
hystrix. Wyr. Thomson,	..	..	..	..	..	..	..	..	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..
Lalage. Wyr. Thomson,	..	..	..	..	..	..	..	..	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..
sp. ind. (1),	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" (2),	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" (3),	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	x	..	..	..	..	..
<i>Agnostus agnostiformis</i> . M'Coy,	..	..	..	..	..	..	..	..	x	x	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Ampyx Hornei</i> . E. & N.,	..	..	..	..	..	..	..	..	x	x	..	..	..	..	..	..	..	..	..	..	..	..	..
Macallumi. Salter,	..	..	..	..	..	..	..	..	x	x	..	..	..	..	..	..	..	..	..	..	..	..	..
? <i>Macconochiei</i> . E. & N.,	..	..	..	..	..	..	..	..	x	x	..	..	..	..	..	..	..	..	..	..	..	..	..
rostratus. Sars,	x	..	x	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
? sp. ind.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Asaphus gigas</i> . De Kay?	..	..	..	..	..	..	..	..	..	x	..	x	..	..	..	..	..	..	..	..	..	..	..
radiatus. Salter,	..	..	..	..	..	..	..	..	x	x	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Bronteopsis Scotica</i> . Salter,	..	..	..	..	..	..	..	..	x	x	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Bronteus Andersoni</i> . E. & N.,	..	..	..	..	..	..	..	..	..	..	x	x	..	..	..	..	..	..	..	..	..	..	..
sp. ind. (1),	..	..	..	..	..	..	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" (2),	..	..	..	..	..	..	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Calymene Blumenbachii</i> . Brong.,	x	x	x	..	..	x	..	x	..	..	..	..	x	..	..	..	..	..	..	..	..	..	..
<i>Cheirurus bimucronatus</i> . Murch.,	x	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	x	..	..	..	..	..
clavifrons. Dalman?	x	..	..	..	..	..	x	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..
gelatinosus. Portlock,	..	..	..	..	..	..	x	x	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..
trispinosus. Young,	..	..	..	..	..	..	..	..	..	..	..	..	x	..	..	..	..	..	..	..	..	..	..
sp. ind. (1),	..	..	..	..	..	..	..	..	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..
" (2),	..	..	..	..	..	..	..	..	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Cybele rugosa</i> . Portlock,	x	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
verrucosa. Dalman,	x	..	..	..	..	..	..	..	x	x	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Cyphaspis megalops</i> . M'Coy,	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Dindymene Cordai</i> . E. & N.,	x	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Eocrinurus punctatus</i> . Brunnich,	..	..	..	..	..	..	..	x	..	..	..	..	..	..	..	..	..	..	..	..	x	x	..
var. arenaceus. Salter,	..	..	..	..	..	..	..	x	..	..	..	..	x	..	..	..	..	x	..	..	..	..	..
calcareus. Salter,	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Ilænus Bowmani</i> . Salter,	x	..	..	..	x	..	..	x	x	x	..	x	x	..	..	..	..	..	..	..	..	..	..
crassicauda. Wahl?	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	x	x	..	..
Davisii. Salter?	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	x	..	..	..	..
æmulus. Salter,	..	..	..	..	..	..	..	..	..	..	..	..	x	..	..	..	..	..	..	..	..	..	..
latus. M'Coy?	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	x	..	..	..
Macallumi. Salter,	..	x	..	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Murchisoni. Salter?	..	..	..	..	..	..	..	..	..	..	..	..	x	..	..	..	..	..	..	..	..	..	..
nexilis. Salter,	..	x	..	..	..	..	..	..	..	..	..	..	?	..	..	..	..	..	..	..	..	..	..
Rosenbergii. Eichw.?	..	x	..	..	..	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Thomsoni. Salter,	..	x	..	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Lichas Barrandei</i> . Fletcher,	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Geikiei. E. & N.,	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Grayi. Fletcher,	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Hibernicus. Portlock,	..	..	..	..	..	..	..	x	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..
laxatus. M'Coy,	..	..	..	..	..	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Phacops Brongniarti</i> . Portlock,	x	x	..	..	..	..	..	..	..	..	..	x	..	..	..	..	..	..	..	..	..	..	..
Stokesii. M. Edwards,	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	x	..	..
<i>Proetus Girvanensis</i> . E. & N.,	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
procerus. E. & N.,	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Remopleurides Colbii</i> . Portlock,	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Barrandei. E. & N.,	..	..	..	..	..	..	..	..	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..
laterispinifer. Portlock,	..	..	..	..	..	..	..	..	..	..	x	..	x	..	..	..	..	..	..	..	..	..	..
sp. ind. (1),	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" (2),	..	..	..	..	..	..	..	..	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Salteria primæva</i> . Wyr. Thomson,	..	..	..	..	..	..	..	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Sphærexochus mirus</i> . Beyrich,	..	..	..	..	..	..	..	..	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Staurocephalus globiceps</i> . Portlock,	..	..	..	..	..	..	..	..	..	..	x	..	..	..	..	..	..	..	..	..	..	..	..
? unicus. Wyr. Thomson,	x	..	..	..	..	..	..	..	x	x	x	..	..	..	..	..	..	..	..	..	..	..	..
<i>Trinucleus concentricus</i> . Eaton?	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
seticornis, var. Bucklandi. Barr,	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
sp. ind.,	..	..	..	..	..	..	..	..	..	..	..	..	..	..	x	..	..	..	..	..	..	..	..
<i>Phyllofoda</i> —																							
<i>Dictyocaris?</i> sp. ind.,	..	..	..	..	..	..	..	..	..	..	..	..	x	..	..	..	..	..	..	..	..	..	x
<i>Peltocaris?</i> sp. ind.,	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Pinnocaris</i> Lapworthi. <i>Eth. jun.</i>,	..	..	..	..	..	..	..	..	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Solenocaris solenoides</i> . Young,	..	..	..	..	..	..	..	..	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Ostracoda</i> —																							
<i>Beyrichia comma</i> . T. R. Jones,	..	..	..	..	..	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
impedens. T. R. Jones,	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	x	..	..	..	..	..	..
Klædeni. M'Coy,	..	..	..	..	..	..	x	..	..	..	..	..	..	..	..	..	x	..	..	..	..	..	..
<i>Cythere Aldensis</i> . M'Coy,	..	..	..	..	..	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
var. major. T. R. Jones,	..	..	..	..	..	..	..	..	..	..	..	..	..	x	..	..	..	..	..	..	..	..	..
Grayana. T. R. Jones,	..	..	..	..	..	..	..	..	..	..	..	..	..	x	..	..	..	..	..	..	..	..	..
Wrightiana. T. R. Jones,	..	..	..	..	..	..	..	..	..	..	..	..	..	x	..	..	..	..	

PLATE X.

LICHAS GEIKIEI, *Eth. jun.*, and *Nich.*, p. 137.

Fig. 1. A decorticated example, exhibiting the cephalic shield, portion of the thorax and the tail. Drummuck Quarry (*Coll. Geol. Survey Scot.*); x 2.

CALYMENE BLUMENBACHII, *Brong.*, p. 140.

Fig. 2. An almost perfect but decorticated specimen from Drummuck—nat. size.

Fig. 3. Another specimen, somewhat deficient about the head, but with the labrum in position, from the same locality—nat. size.

Fig. 4. Cephalic shield without the free cheeks, but with portions of the integument remaining. Drummuck Quarry—nat. size. Fig. 4 *a*, ornamentation of integument enlarged.

Fig. 5. Pygidium, approaching the true form of *Calymene Blumenbachii*. Drummuck—nat. size.

Fig. 6. Two-thirds of a small individual, probably referable to this species, decorticated. Mulloch Hill—nat. size.

ENCRINURUS PUNCTATUS, var. CALCAREUS, *Salter*, pp. 108 and 205.

Fig. 7. A decorticated pygidium, with the base of the mucronate extension preserved. Penkill—nat. size.

REMOPLEURIDES COLBII, *Portlock*, p. 146.

Fig. 8. A decorticated example of the glabella and a portion of the body; the elongated eyes are visible at the side of the former. Fig. 8 *a*, the glabella seen from the front, exhibiting the tongue-like forward projection. Drummuck—nat. size.

REMOPLEURIDES, *sp. ind.*, p. 149.

Fig. 9. A decorticated fragment, perhaps referable to the last, but probably different. Fig. 9 *a*, ornamentation of glabella enlarged. Drummuck—nat. size.

REMOPLEURIDES LATERISPINIFER, *Portlock*, p. 149.

Fig. 10. A portion of the body, with one of the elongated lateral spines in position. Ardmillan; x 2.

PLATE X.—*continued.*

Fig. 11. Another specimen, showing in addition the granular ornamentation, of the surface. Ardwell; x 2.

REMOPLEURIDES, *sp. ind.*, p. 150.

Fig. 12. Portion of an individual, with the glabella, eyes, and a few segments preserved. Balcletchie; x 2.

REMOPLEURIDES BARRANDII, *Eth. jun.*, and *Nich.*, p. 151.

Fig. 13. A glabella, with the eyes and furrows. Balcletchie; x 2.

Fig. 14. Another, but similar, example, from the same locality; x 2.

Fig. 15. A glabella, with the furrows faintly marked. Balcletchie; x 2.

Fig. 16. The only specimen with the free-cheeks, and one of the genal spines in position. Balcletchie; x 3.

ASAPHUS RADIATUS, *Salter*, p. 153.

Fig. 17. Cast of a pygidium, named by the late Mr. J. W. Salter (*Coll. Mus. Pract. Geol.*)—nat. size.

ASAPHUS GIGAS, *De Kay* (?), p. 153.

Fig. 18. Cast of a pygidium, probably referable to this species. Balcletchie—nat. size.

Fig. 19. Another specimen, from Ardmillan Brae (*Coll. Mus. Pract. Geol.*)—nat. size.

ASAPHUS, *sp. ind.*, p. 154.

Fig. 20. A pygidium, showing traces of the peculiar glands described by the late Mr Salter. Balcletchie—nat. size.

BRONTEOPSIS SCOTICA, *Salter*, p. 167.

Fig. 21. The most complete specimen known—two-thirds of the entire body; the hypostome is seen *in situ*. Balcletchie—nat. size.

Fig. 22. A portion of the glabella, with the peculiar pit-like furrows; one of the original specimens upon which Mr Salter founded the name. Pen-whapple Glen (*Coll. Mus. Pract. Geology*)—nat. size.

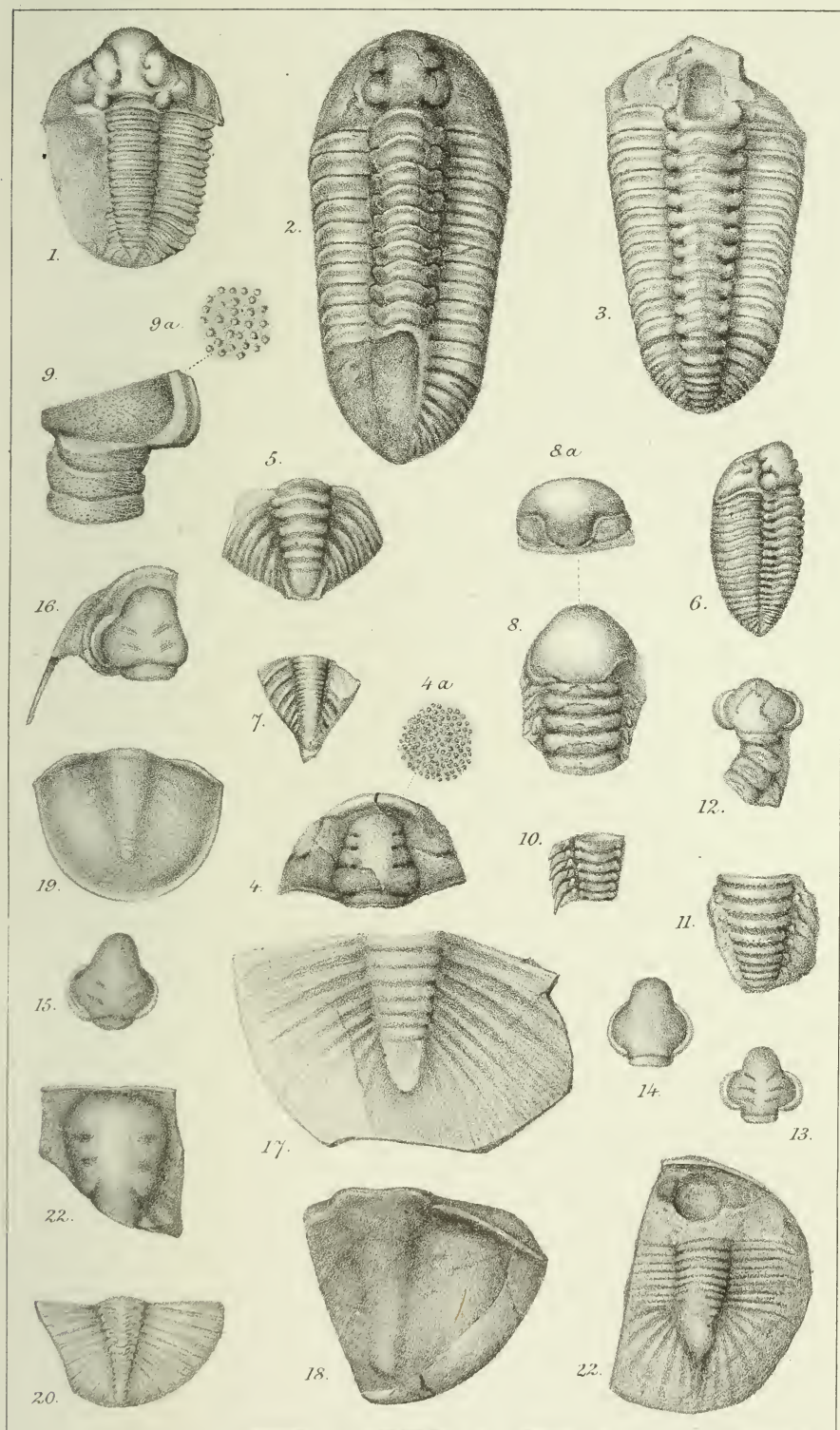


PLATE XI.

BRONTEOPSIS SCOTICA, *Salter* (cont.), p. 167.

- Fig. 1. Portion of the glabella, with the furrow-depressions. Balclatchie—nat. size.
Fig. 2. A pygidium, from the same locality—nat. size.
Fig. 3. Another specimen, same locality, with the terminal appendage of the axis well displayed—nat. size.
Fig. 4. One of the original specimens, so named by the late Mr Salter. Penwhapple Glen (*Coll. Mus. Pract. Geology*)—nat. size.
Fig. 5. A tail of a young individual. Balclatchie—nat. size.

ILLÆNUS BOWMANI, *Salter*, p. 155.

- Fig. 6. An almost complete specimen. Balclatchie—nat. size.
Fig. 7. Side-view of the head of a small fragmentary individual, distorted, with one of the eyes seen *in situ*. Balclatchie; x 2.
Fig. 8. A large head, which from the characteristic groove, &c., appears to be perhaps referable to this species. (*Hunterian Museum*)—nat. size.

ILLÆNUS THOMSONI, *Salter*, p. 156.

- Fig. 9. A large but badly preserved pygidium. Mulloch Hill—nat. size.

ILLÆNUS ÆMULUS, *Salter* (?), p. 157.

- Fig. 10. A pygidium, with portions of the integument preserved, showing the broadly inverted and V-shaped sculpture. Penkill—nat. size.

ILLÆNUS NEXILIS, *Salter* (?), p. 158.

- Fig. 11. An almost complete example—nat. size.
Fig. 12. A large epistome resembling those referred by Mr Salter to this species. Penkill—nat. size.
Fig. 13. A smaller example from the same locality—nat. size.

ILLÆNUS ROSENBERGII, *Eichwald* (?), p. 159.

- Fig. 14. A large pygidium, presumed to be that of this species.—nat. size.

REMOPLEURIDES LATERISPINIFER, *Portlock*, p. 149.

- Fig. 15. An almost entire specimen, with the integument removed. Ardmillan; x 3.

REMOPLEURIDES BARRANDII, *Eth. jun.*, and *Nich.*, p. 151.

- Fig. 16. A glabella, with the eyes and surface-ornamentation preserved. Ardmillan; x 4.

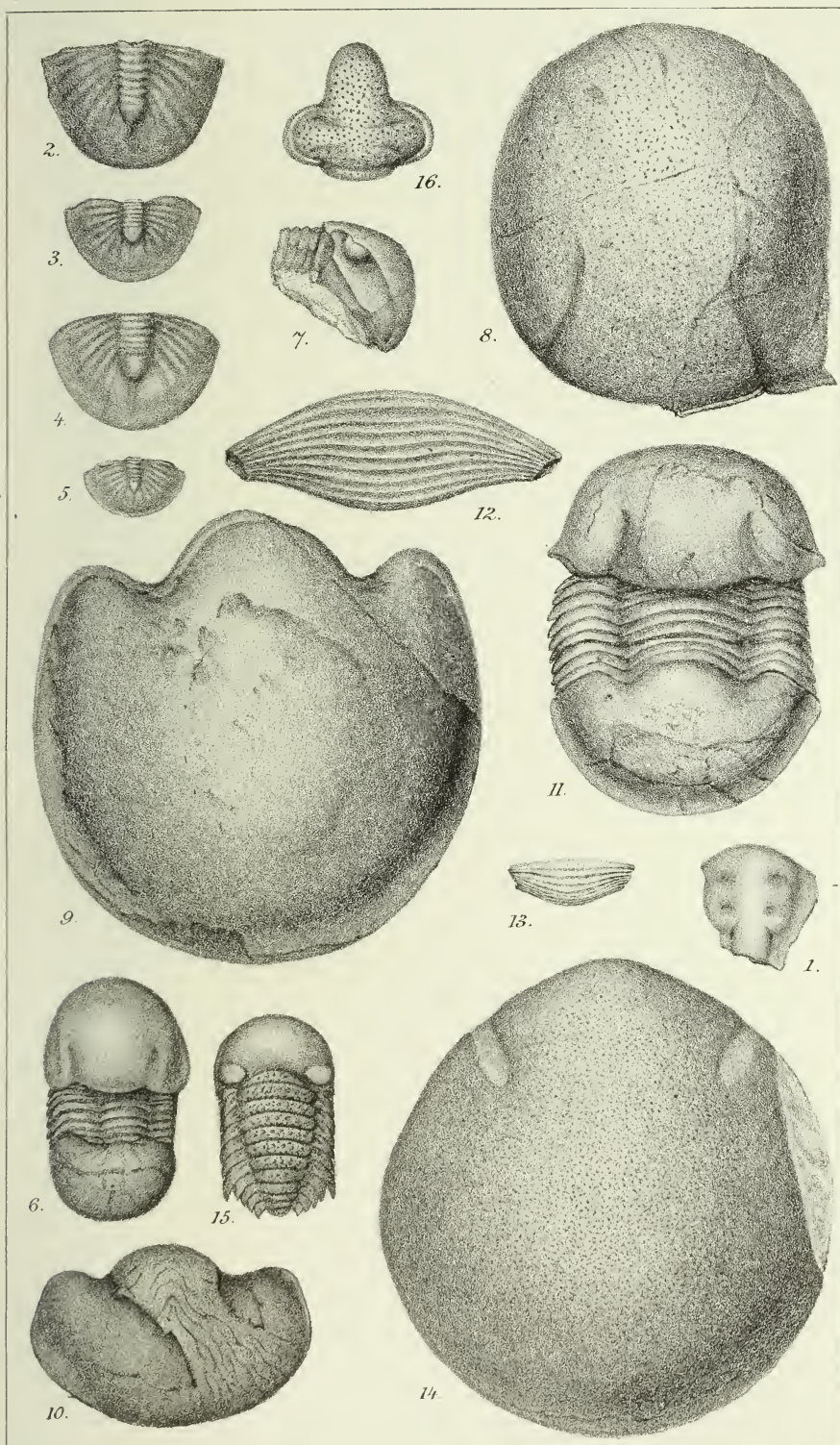


PLATE XII.

ILLÆNUS MURCHISONI, *Salter* (?), p. 161.

Fig. 1. A portion of a large specimen, probably referable to this species. It is placed upside-down to show the marginal striations. Penkill—nat. size.

ILLÆNUS MACALLUMI, *Salter*, p. 162.

Fig. 2. Cast of a rather small pygidium. Mulloçh Hill—nat. size.

BRONTEUS ANDERSONI, *Eth. jun.*, and *Nich.*, p. 162.

Fig. 3. A pygidium, drawn from two specimens, showing the trilobation of the axis, with its segments, and the characteristic concentric laminæ. Penkill—nat. size.

Fig. 4. A similar specimen, showing traces of trilobation, &c. Penkill—nat. size.

Fig. 5. The most complete specimen known, showing a portion of the glabella and thorax. Penkill (*Hunterian Mus. Coll.*)—nat. size.

BRONTEUS, *sp. ind.*, p. 165.

Fig. 6. Remains of a large pygidium, showing numerous strong, radiating ridges from the edge of the axis, which is not preserved. Craighead Limestone—nat. size.

PROETUS GIRVANENSIS, *Eth. jun.*, and *Nich.*, p. 169.

Fig. 7. The most perfect specimen known, quite free of the matrix. Fig. 7 *a*, thorax and pygidium. Fig. 7 *b*, side-views of head, thorax, and pygidium. Fig. 7 *c*, cephalic shield, showing the small eyes and broad cheeks. Fig. 7 *d*, the same, from before, exhibiting the space between the anterior margin of the glabella and the front margin of the shield. Drummuck (*Coll. Mus. Pract. Geol.*)—nat. size.

Fig. 8. A very rotund and short variety, showing the quadrate glabella, broad cheeks, and eyes in position. Drummuck (*Coll. Geol. Survey Scotland*); x 1½.

Fig. 9. Another very perfect specimen from the same locality; full view of the body. Fig. 9 *a*, side-view; x 2.

PLATE XII.—*continued.*

Fig. 10. A specimen, with the glabella-furrows preserved, and in an equally good state of preservation with the foregoing. Drummuck; x 2.

PROETUS PROCERUS, *Eth. jun.*, and *Nich.*, p. 174.

Fig. 11. General view, showing the longer and more slender form, and the more elongated glabella than in the last species. Fig. 11 a, side-view. Drummuck; x 3.

ILLÆNUS ÆMULUS, *Salter* (?), p. 157.

Fig. 12. A tail and eight thoracic segments, believed, from the ornamentation of the former, to belong to this species. Penkill—nat. size.

Fig. 13. A glabella, bearing the same kind of sculpture, and from the same locality—nat. size.

AMPYX ROSTRATUS, *Sars.*, p. 178.

Fig. 14. The upper side of a specimen, clear of the matrix, showing the glabella and some of the thoracic somites. Drummuck (*Coll. Mus. Pract. Geol.*)—nat. size.

Fig. 15. The under surface of the same specimen, with the pygidium pressed up against the under portion of the head—nat. size.

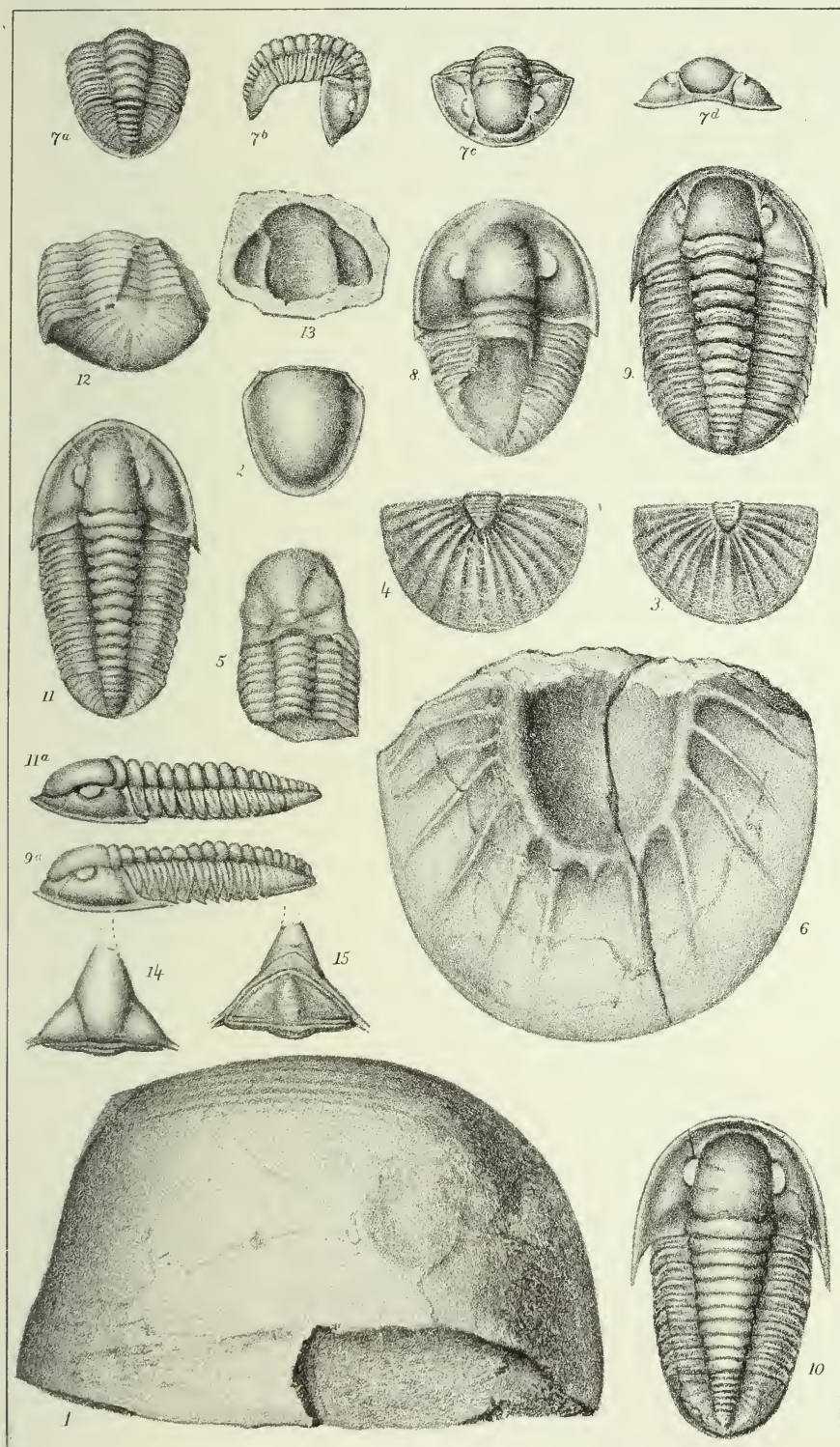


PLATE XIII.

AMPYX ROSTRATUS, *Sars.*, p. 178.

- Fig. 1. The glabella, with portions of the frontal and genal spines preserved. Drummuck—nat. size.
 Fig. 2. Another glabella, in which the dépressions along the axial furrows are visible. Fig. 2 *a*, side-view of the same. Drummuck—nat. size.
 Fig. 3. Pygidium, with the segmented and tuberculated axis preserved. Drummuck; $\times 1\frac{1}{2}$.

AMPYX HORNEI, *Eth. jun.*, and *Nich.*, p. 184.

- Fig. 4. A large cephalic shield, without the free-cheeks. The pyriform and mammillary glabella, with its apical tubercle, is well preserved. The radiatory ridges of the fixed cheeks are also visible. Balclatchie—nat. size.
 Fig. 5. Another shield, drawn from two specimens. The anterior truncated margin is well shown, and also the radiating ridges previously mentioned. Balclatchie (*Mus. Pract. Geol. Coll.*, and *Gray Coll.*)—nat. size.
 Fig. 6. A shield in which there are traces of genal spines remaining, from Balclatchie—nat. size.
 Fig. 7. A thorax and pygidium of this species. Balclatchie—nat. size.
 Fig. 8. Another pygidium, isolated. Balclatchie; $\times 2$.

AMPYX MACALLUMI, *Salter*, p. 180.

- Fig. 9. A cephalic shield, without the free-cheeks, drawn from two specimens. The form of the glabella, the course of the axial furrows, and traces of the genal spines, are shown. Balclatchie; $\times 2$.
 Fig. 10. Another shield, without the free-cheeks, but having the base of the frontal spine preserved. Balclatchie—nat. size.
 Fig. 11. View of the under surface of head (rostral shield) with the genal spines in position. Fig. 11 *a*, portion enlarged to show striation. Balclatchie—nat. size.
 Fig. 12. A pygidium, in which the half-segmentation of the lateral lobes is well seen. Balclatchie; $\times 2$.

PLATE XIII.—continued.

TRINUCLEUS SETICORNIS, *His.*, var. BUCKLANDI, *Barr.*, p. 190.

- Fig. 13. General view of an almost perfect specimen. Drummuck—nat. size.
- Fig. 14. The cephalic shield of a young form, showing the ocular tubercles, but no eye-line. Pomeroy, Ireland (*Coll. Mus. Pract. Geol.*); x 2.
- Fig. 15. A young form, in which the cephalic fringe is particularly well preserved. Fig. 15 *a*, side-view. Fig. 15 *b*, the depressions or funnels of the fringe enlarged. Drummuck.
- Fig. 16. Another cephalic shield, in which the glabella-furrows are well shown. Drummuck—nat. size.
- Fig. 17. A portion of the reticulation ornamenting the glabella, enlarged.
- Fig. 18. Front view of a shield, in which the ridges separating the parallel lines of fringe-depressions are well preserved. Drummuck; x 2.
- Fig. 19. Side-view of a cast of a remarkably well developed fringe, in which the non-punctate striated space is visible. Drummuck (*Coll. Mus. Pract. Geol.*); x 2.
- Fig. 20. Cephalic shield of a young individual in which the ocular tubercles and "eye-lines" are preserved. Drummuck; x 2.

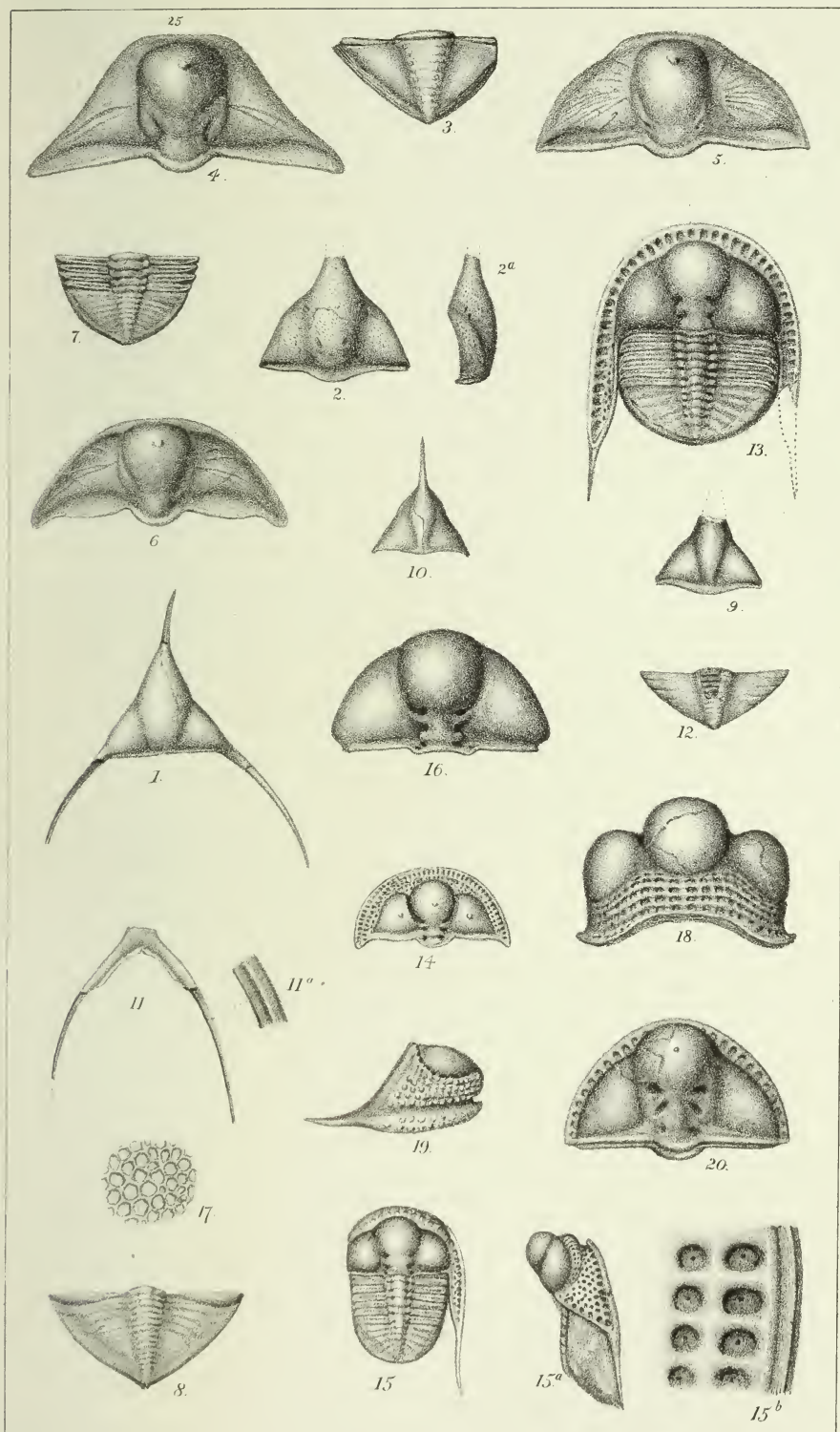


PLATE XIV.

AMPYX (?) MACCONOCHIEI, *Eth. jun.*, and *Nich.*, p. 183.

Fig. 1. A small individual, probably referable to this genus, from which the integument has been removed. Balcletchie; x 4.

TRINUCLEUS, *sp. ind. (sp. a)*, p. 198.

Fig. 2. A portion of the fringe and one of the genal spines of a species of *Trinucleus*. Shalloch Mill; x $1\frac{1}{2}$.

TRINUCLEUS, *sp. ind. (sp. b)*, p. 198.

Fig. 3. One of the cheeks and a narrow fringe, from the same locality as the last; x $1\frac{1}{2}$.

TRINUCLEUS, *sp. ind. (sp. c)*, p. 198.

Fig. 4. A very triangular pygidium, probably referable to this genus. Shalloch Mill—nat. size.

SALTERIA PRIMEVA, *Wyr. Thomson*, p. 199.

Fig. 5. An almost complete specimen, in the collection of the Hunterian Museum. Balcletchie; x 2?

AGNOSTUS AGNOSTIFORMIS, *McCoy*, p. 200.

Fig. 6. A figure drawn from a series of specimens, in which the cephalic and pygidium spines are more or less visible. Balcletchie; x 4.

PHACOPS BRONGNIARTI, *Portlock*, pp. 99 and 201.

Fig. 7. A very large and almost complete specimen, but a little crushed here and there. Drummuck (*Coll. Geol. Survey, Scot.*)—nat. size.

Fig. 8. A well-preserved glabella, eyes, and fixed cheeks. Ardmillan; x 2.

CHEIRURUS BIMUCRONATUS, *Murch.*, pp. 100 and 202.

Fig. 9. A portion of the thorax of a very large decorticated example (*Coll. Geol. Survey, Scot.*) Drummuck—nat. size.

CHEIRURUS CLAVIFRONS, *Dalman* (?), pp. 101 and 202.

Fig. 10. A glabella, in which the two kinds of ornamentation are visible, with portions of the fixed cheeks. Drummuck—nat. size; 10 a, and 10 b, the ornamentation much enlarged.

PLATE XIV.—*continued.*

CHEIRURUS? *sp. ind. (sp. a)*, p. 203.

Fig. 11. A small pygidium, perhaps referable to a species of this genus. Balcletchie; x 4.

CHEIRURUS? *sp. ind. (sp. b)*, p. 203.

Fig. 12. Portion of a peculiar cephalic shield, consisting of the glabella and fixed cheeks, with an anterior prolongation of the former, and the glabella and neck furrows. Balcletchie; x 2.

CYBELE RUGOSA, *Portlock*, pp. 112 and 205.

Fig. 13. This figure is represented in Pl. VIII., fig. 5, but as that illustration does not give a satisfactory and fair representation of the specimen, it is here redrawn. It will be noticed that in the former the genal and thoracic pleural spines were left out—nat. size.

ACIDASPIS? *sp. ind.*, p. 206.

Fig. 14. A specimen, generally supposed from the general appearance of the thorax and tail to be of this genus. It is a mere mould in a shaley matrix, but has the position of the labrum defined (*Coll. Geol. Survey, Scot.*) Near Bargany Pond; x 2.

PROETUS? or ACIDASPIS? *sp. ind.*, p. 206.

Fig. 15. A mould, in a similar rock to the last (*Coll. Geol. Survey, Scot.*) Near Bargany Pond; x 4.

AMPYX? *sp. ind.*, p. 206.

Fig. 16. Portion of the cephalic shield of a Trilobite of doubtful determination. The surface is in places tubercular. Balcletchie; x 4.

PINNOCARIS LAPWORTH, *Eth. jun.*, p. 210.

Figs. 17-20. Various specimens of the half-carapace, with the delicate concentric ornament. Fig. 17 has a small object near it which may be one of the tail-spines. Balcletchie—nat. size.

PELTOCARIS? *sp. ind.*, p. 212.

Fig. 21. A carapace, of which the two halves are somewhat displaced, probably referable to this genus (*Coll. Geol. Survey, Scot.*) Penwhapple Burn; x 2.

TURRILEPAS SCOTICA, *Eth. jun.*, p. 214.

Figs. 22-25. Three forms of plates of this species; three of them exhibit the fine needle-like extremity. Balcletchie; x 3.

Fig. 26. Another form of plate from the same locality; x 4.

Fig. 27. The "reticulate plate," same locality; x 4.

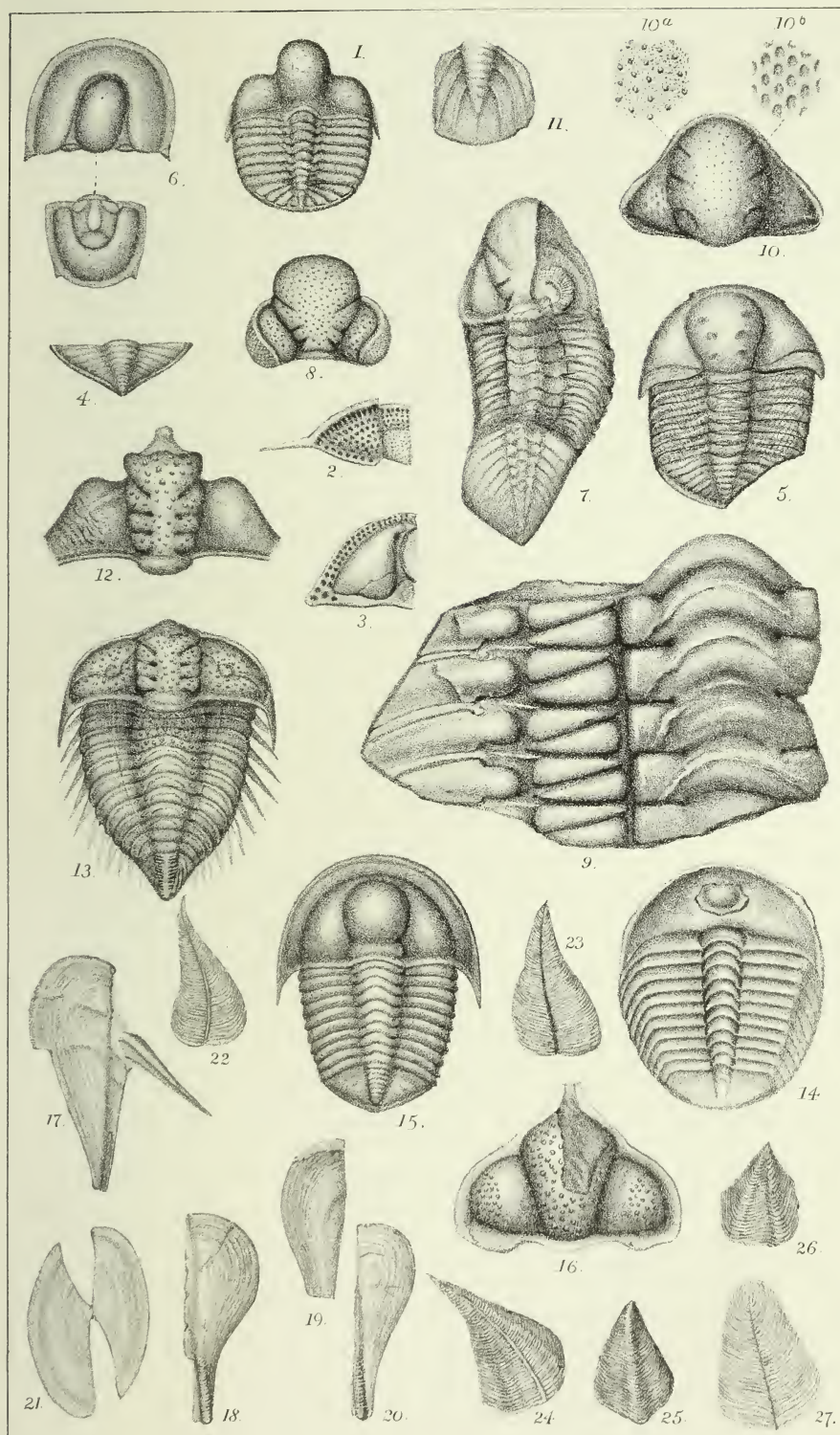


PLATE XV.

CYTHERE ALDENSIS, *McCoy*, p. 216.

- Fig. 1. A bivalved carapace, somewhat broken. Fig. 1 *a*, side-view. Fig. 1 *b*, dorsal view. Fig. 1 *c*, end-view of one valve. Aldens.
- Fig. 2. Another example. Fig. 2 *a*, side-view of a right valve. Fig. 2 *b*, end-view of same. Aldens.
- Fig. 3. Side-view of a left valve showing some trace of the muscle-spot.

C. ALDENSIS, *McCoy*, var. *major*, *Jones*, p. 216.

- Fig. 4. Three views of an example from Aldens. Fig. 4 *a*, side-view of the left valve, somewhat crushed. Fig. 4 *b*, edge-view of the same. Fig. 4 *c*, end-view of the same.

CYTHERE GRAYANA, *Jones*, p. 217.

- Fig. 5. Two views of an example from Aldens. Fig. 5 *a*, side-view of the left valve. Fig. 5 *b*, end-view of the same.
- Fig. 6. Two views of another specimen from the same locality. Fig. 6 *a*, side-view of a left valve, with a muscle-mark. Fig. 6 *b*, end-view of the same.

CYTHERE WRIGHTIANA, *Jones and Holl*, p. 217.

- Fig. 7. Two views of a specimen from the greenish-black limestone of Aldens. Fig. 7 *a*, right valve, side-view. Fig. 7 *b*, end-view of the same.

BEYRICHIA KLÆDENI, *McCoy*, p. 218.

- Fig. 8. Two views taken from different examples. Fig. 8 *a*, hollow cast of the exterior of the left valve. Fig. 8 *b*, side-view of a right valve. Thrave Glen.

BEYRICHIA COMMA, *Jones*, p. 219.

- Fig. 9. A bivalved carapace, imperfect at the edges. Fig. 9 *a*, side-view of a left valve. Fig. 9 *b*, end-view of the carapace. Fig. 9 *c*, edge-view of the same, from the greenish fine-grained sandstone of Thrave Glen.

PLATE XV.—*continued.*

BEYRICHTIA IMPENDENS, *Jones*, p. 219.

Fig. 10. External casts, under various conditions of pressure, from Girvan and the Pentland Hills. Fig. 10 *a*, normal form of casts. Figs. 10 *b* and *c*, casts of specimens differently squeezed (*Coll. Geol. Survey, Scot.*)

PRIMITIA BARRANDIANA, *Jones*, p. 220.

Fig. 11. Various views of valves and casts, showing different development of the sulcus on the shell, and impressions on the casts.

Fig. 11 *a*, Side-view of a valve with faint sulcus.

Fig. 11 *b*, Side-view of a cast, showing one large and two slight furrows.

Fig. 11 *c*, Side-view of a valve with three slight furrows, the middle one strongest and marked with a pimple.

Fig. 11 *d*, Side-view of a valve, somewhat irregular in form, with traces of two furrows.

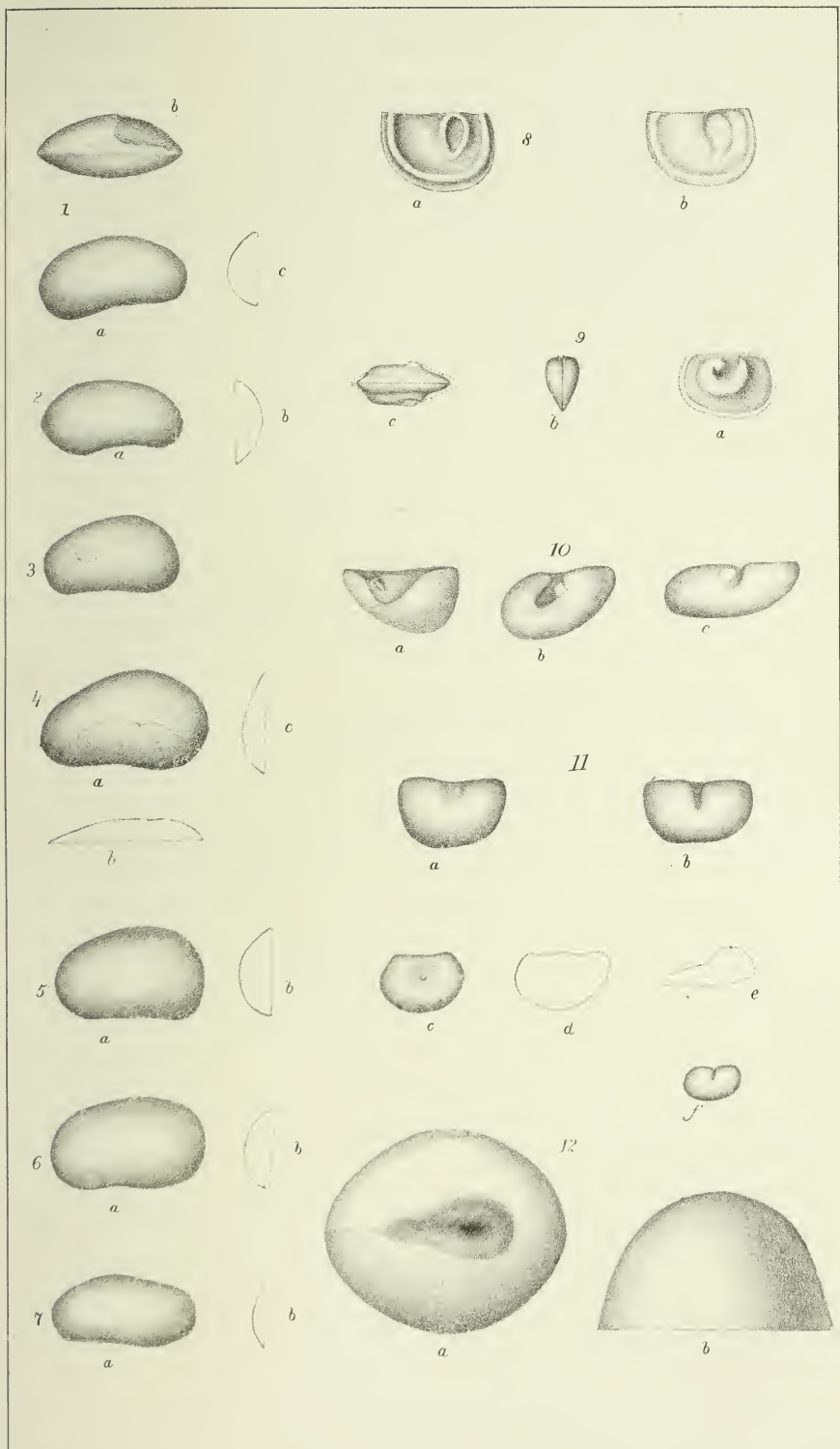
Fig. 11 *e*, Edge-view of the same.

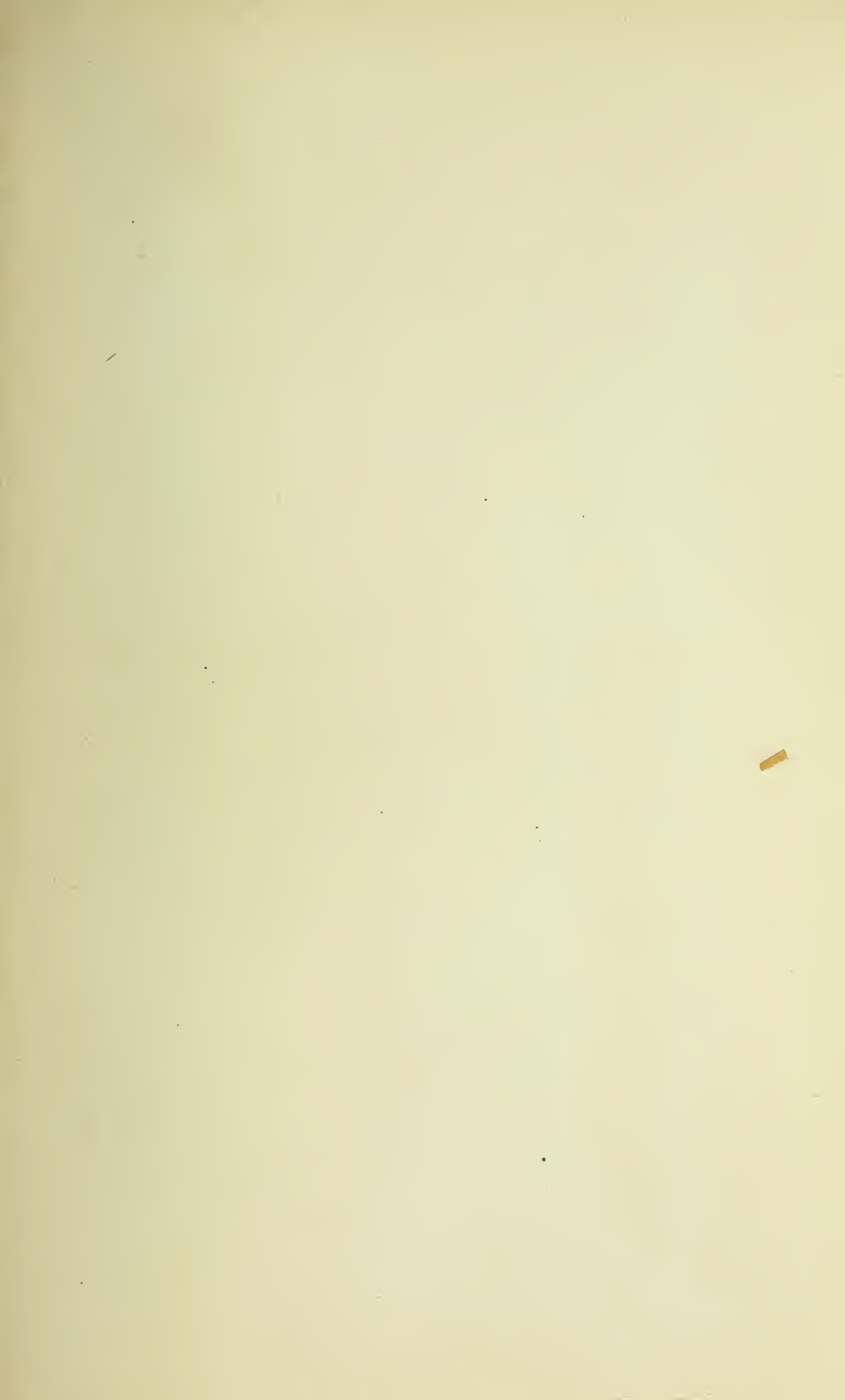
Fig. 11 *f*, Side-view of a valve retaining a small portion of the shell; and showing a deep median sulcus, also a faint anterior (?) sulcus with a small pimple.

ENTOMIS GLOBULOSA, *Jones*, p. 223.

Fig. 12. Internal cast of a sub-conical valve, modified by pressure. Fig. 12 *a*, surface-view of a tent-shaped cast, with a pit at apex, and a short furrow on the longest axis of the body. Fig. 12 *b*, side-view of the same.

(All the figures on Plate XV. are magnified twelve diameters.)





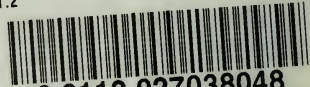
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